

### STRUCTURE OF THE MICROCARD

1. Read from left to right.
2. Coordinate title (appears on each coordinate).

E16	Product/assembly/test step		
	Coordinate		

3. Delimitation of sections

==>	<==>	<==	=> <=
Beginning	Mid-section	End	One-page section

4. Reference to relevant steps in test specifications (e.g. coordinate C06) | C06 |
5. Vehicle-specific features are identified on coordinates A01 ... B08 with the adjacent symbol (e.g. new tools, installation positions, etc.)
6. For Table of Contents see Coordinate | N20 |
7. THE TROUBLE-SHOOTING CHART IS FOUND ON COORDINATE | C01 |

## SPECIAL FEATURES

This microcard contains the LH-Jetronic trouble-shooting instructions for the following model valid at the time of writing:

Saab 900 Turbo 16 valves, charge-air cooling,  
4-cyl., displacement 2.0 l, 128 kW (175  
bhp), as of March 84.

- Exhaust-gas recirculation
  - O-ring connection of solenoid-operated injection valves
  - Fuel filter located in engine compartment
  - Exhaust-gas recirculation
  - Exhaust turbocharging with charge-air cooling
  - Knock control (Saab co. APC system)
  - Mechanical throttle-valve damper. The damper acts as a mechanical brake of throttle-valve movement during closing.
  - Fuel filter underneath vehicle as of Aug. 85
  - Control unit term. 4 starting information N/A as of Aug. 84.
  - Until 7.84 control unit 0 280 000 517
  - From 8.84 until 7. 85 control unit 0 280 00 521
- Control units with tp signal triggering
- from 8.85 to 7.86 control unit 0 280 000 633
  - from 8.86 control unit 0 280 000 547

### Testing:

For testing the LH2.1-Jetronic and from 8.84 the LH2.2-Jetronic with the universal test adapter, a Y-adapter cable is required for peripherals and control unit inspection.





## RAPID DIAGNOSTIC CHART FOR THE UNIVERSAL TEST ADAPTER








The rapid diagnostic chart below makes it possible for the experienced L-Jetronic expert to check the electrical portion of the system quickly using the universal test adapter.

The rapid diagnostic chart contains the following information:

- Sequence of test steps
- Position of the V and  $\Omega$  program switch
- Comments on operation of the universal test adapter or other components
- Test specifications for the motortester and multi-meter
- Cross-reference to coordinates for the pertinent detailed testing and trouble-shooting program.



# Rapid diagnostic chart for the universal test adapter

Test step	Switch setting		Measurement	Note Connect adapter lead to periphery only	Test specifications (reading)	For trouble-shooting See Coordinates
	V	$\Omega$				
1		5	Resistance of the temperature sensor NTC II (engine temperature). On the control unit plug between Term. 2 and Term. 11.	---	(+15°C...+30°C): 1450...3300 $\Omega$ (+ 80° C): 280...360 $\Omega$	C 12
2		6	Resistance of the output stage ground terminal. On the control unit plug between Term. 25 and Term. 11.	---	0 ... 10 $\Omega$	C 14
3		7	N/A as of 8.84 Resistance of ground terminal for sensors. At control-unit plug between terms. 5 and 11.	---	0 ... 10 $\Omega$	C 16
4		8	Resistance of all 4 solenoid-operated fuel-injection valves connected in parallel, and in series with these the auxiliary-air device. On the control unit plug between Term. 13 and Term. 11	1. Unplug the connecting plug of the auxiliary-air device and insert a short-circuit jumper into the plug. 2. Remove the short-circuit jumper and plug the connecting plug back on to the auxiliary-air device.	1. (+15°...30°C): 6.80...9.30 $\Omega$ (+ 80° C): 7.00...9.80 $\Omega$ 2. The reading must now become approx. 50 $\Omega$ greater.	C 18
5		9	Resistance of the idle contact in the throttle-valve switch. On the control unit plug Term. 3 and Term. 11.	1. Accelerator pedal in at rest position 2. Step half-way down on accelerator 3. Release accelerator pedal	1. 0...10 $\Omega$ 2. $\infty$ $\Omega$ 3. After approx. 3...6s: 0...10 $\Omega$	C 22
6		10	Resistance of the full-load contact in the throttle valve switch. On the control unit plug between Term. 12 and Term. 11	Step all the way down on the accelerator	0 ... 10 $\Omega$	D 3
7		21	Resistance of the potentiometer for adjustment of the idle-mixture. On the control unit plug Term. 14 and Term. 6.	Reading depends on the adjustment	150 ... 600 $\Omega$	D 5
8	4	21	N/A as of 8.84 Voltage from starting motor term. 50. At control-unit plug between terms. 4 and 11.	Shift into neutral and start	8 ... 15 V	D 7

**A4**

Rapid diagnostic chart

Saab



**A5**

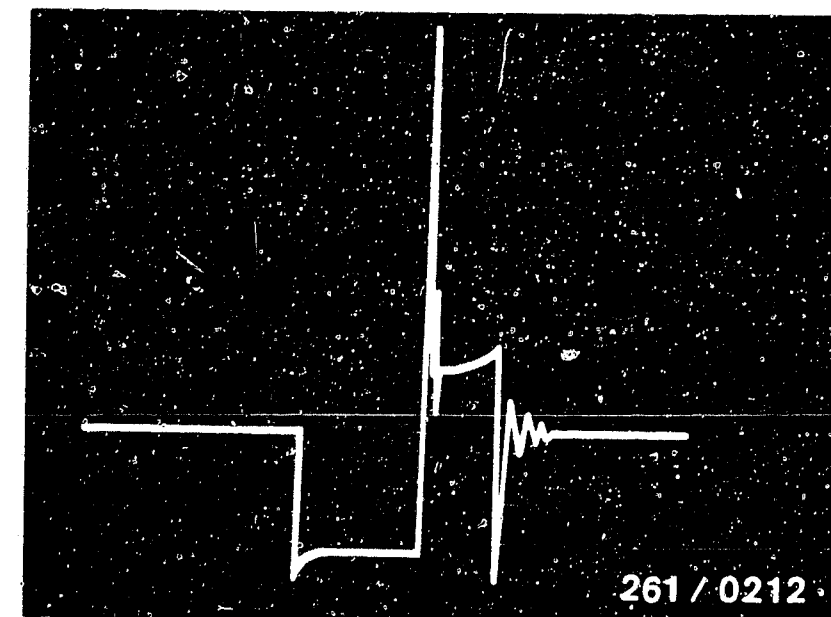
Rapid diagnostic chart

Saab

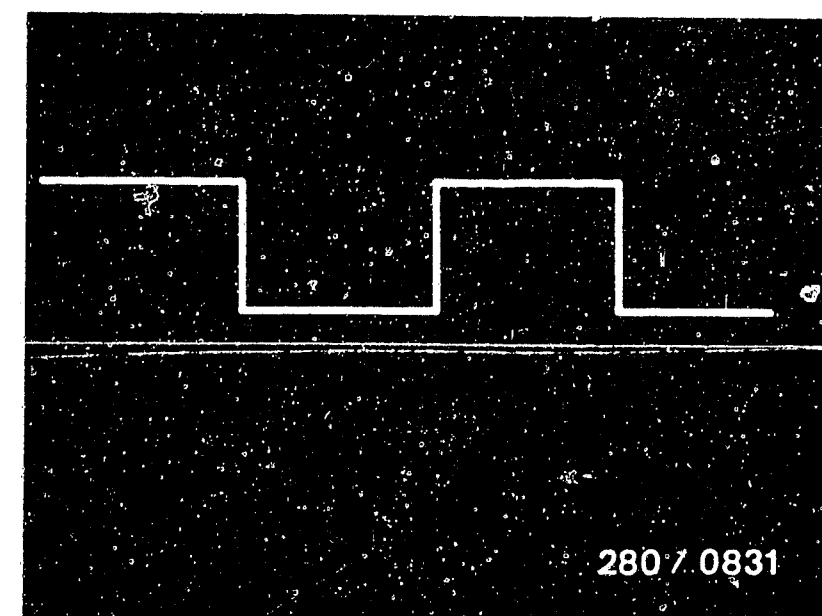


# Rapid diagnostic chart for universal test adapter

Test step	Switch setting		Measurement	Note Connect adapter lead to periphery only	Test specifications (reading)	For trouble-shooting see Coordinates
	V	Ω				
9	5	21	Voltage pulses. At control-unit plug between term. 1 and term. 11.	Ignition "ON". Measure primary signal or $t_D$ signal with oscilloscope. Engage gear and start.	Until 7.85: term. 1 signal (upper ill.) as of 8.85 $t_D$ signal (lower ill.)	D 9
10	6	21	Press button 4. Voltage from main relay Term. 87. On control unit plug between Term.9 and Term. 11.	Ignition "ON"	8 ... 15 V	D 13
11	7	21	Voltage from ignition coil Term. 15. On control unit plug between Term.7 and Term.11	Ignition "ON"	8 ... 15 V	D 15
12	8	21	Voltage on main relay Term. 85. On control unit plug between Term.21 and Term. 11.	Ignition "ON"	8 ... 15 V	D 17
13	9	21	Press key 4. Voltage at pump relay term.85. At control-unit plug between terms. 17 and 11.	Ignition "ON"	8 ... 15 V	D 19
Connect adapter lead to periphery and control unit. (Ignition "OFF"). Then warm up the engine (normal operating temperature).						
14	3	21	Output voltage on the hot-wire air-mass sensor. On control unit plug between Term.7 and Term. 6	When the engine speed changes, the output voltage must also change.	2 ... 5 V	D 21



Until 7.85  
Term. 1 signal from term. 1 ignition coil (primary signal)  
As of 8.85  
 $t_D$  signal from ignition trigger box term. 1



**A6**

Rapid diagnostic chart  
Saab



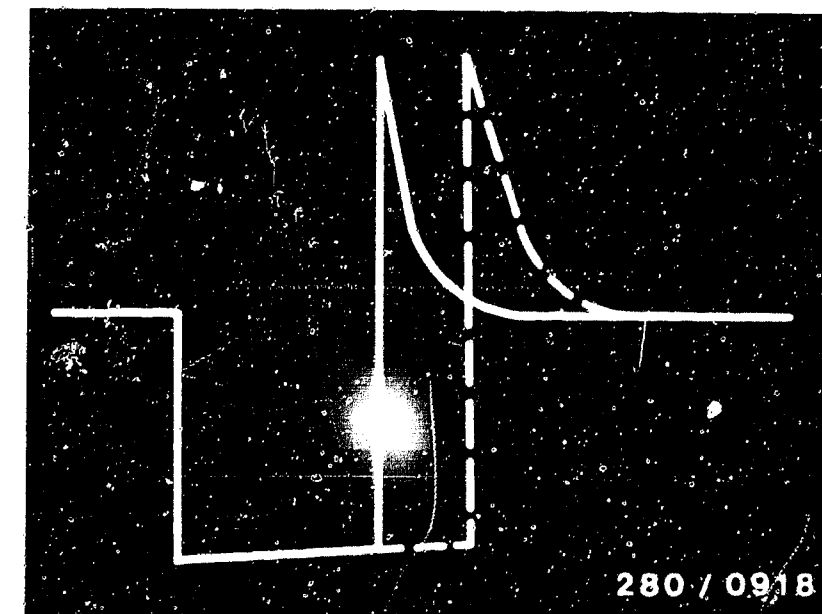
**A7**

Rapid diagnostic chart  
Saab



# Rapid diagnostic chart for universal test adapter

Test step	Switch setting		Measurement	Note Connect adapter lead to periphery only	Test specifications (reading)	For troubleshooting see (Coordinates)
	V	Ω				
Functional test of the control unit (engine at normal operating temperature).						
15	12	21	Check the injection signal (t.) from the control unit using an oscilloscope. On control unit plug between Term.13 and Term.11.	---	See Figure at top	D 23
16	12	21	Press button 1. Warm-up.	As for test step 15, but after pressing key (NTC II cold) injection duration must increase somewhat or CO value increases.		E 1
17	12	21	Press button 2. Warm-up (after cut-back)	As for test step 15, except after pressing key (NTC II warm) injection duration or CO value must remain constant.		E 3
18	12	21	Press button 6. Full-load enrichment.	When key 6 is pressed, either the injection duration, engine speed, or CO value must increase.		E 5
19	13	21	Self-cleaning. On the control unit plug between Term. 8 and Term. 11.	Before this test, the engine speed must be greater than 2000 min <sup>-1</sup> , and the engine temperature must be min. +60°C. After that, ignition "OFF". → Reading for voltage after approx. 4 s.:	2 .. 5 V (Duration of reading approx. 1 s.)	E 7



A8

Rapid diagnostic chart  
Saab



A9

Rapid diagnostic chart  
Saab



## TEST SPECIFICATIONS

Pressure regulator 0 280 160 214, 0 280 160 255

● Fuel pressure 2.3 ... 2.7 bar

Pressure regulator 0 280 160 264

● Fuel pressure 2.6 ... 3.0 bar

### Electric fuel pump

● Fuel delivery (measured in the return): min. 900 cm<sup>3</sup>/30 s

● Connection voltage (under load): min. 12 V

### Temperature sensor II (engine) (blue)

● Internal electrical resistance at ambient temperature (+15° ... +30° C): 1450 ... 3300 Ω  
Engine at normal operating temperature (approx. + 80° C): 280 ... 360 Ω

### Solenoid-operated fuel-injection valve (at 20° C)

● Internal electrical resistance: 14.5 ... 17.0 Ω

### Exhaust turbocharger

Max. charge-air pressure 0.8 ... 0.9 bar

Basic charge-pressure 0.37... 0.43 bar

Pressure-sensing switch (switch pressure) 1.05... 1.15 bar



### Hot-wire air-mass sensor

- Internal electrical resistance
  - Between Term. 6 and Term. 3: 0 ... 1100  $\Omega$
  - Between Term. 5 and Term. 3: 3.6 ... 4.1  $\Omega$

### Auxiliary-air device

- Internal electrical resistance
  - Manual transmission: 40 ... 75  $\Omega$
  - Automatic transmission: 30 ... 65  $\Omega$

### Idle adjustment

(Engine at normal operating temperature, approx. +80° C)

Manual and automatic transmissions  
(dimmer light switch on): 775 ... 925 min<sup>-1</sup>

### CO-adjustment

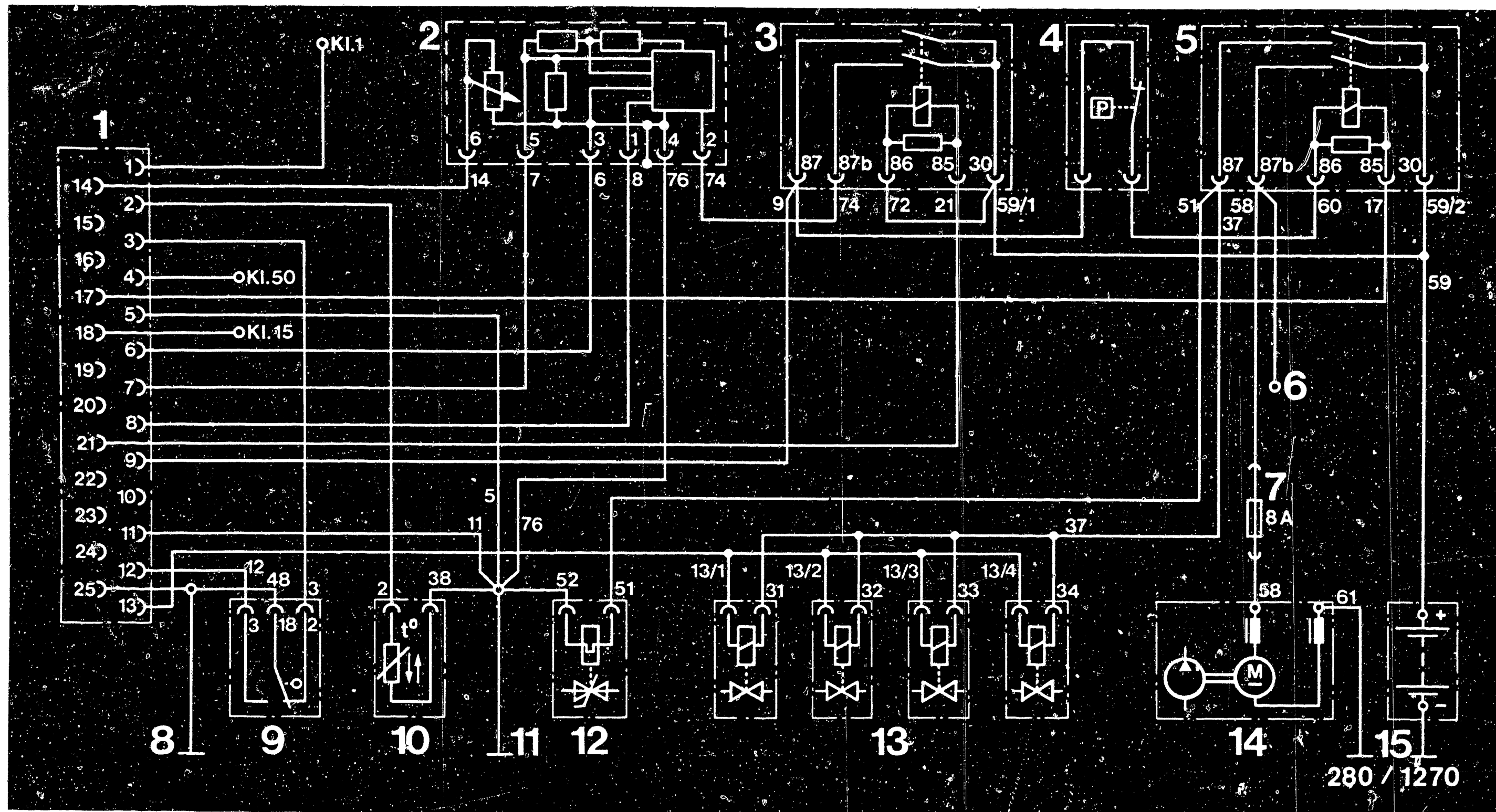
At idle speed: 0.9 ... 1.6 vol. % CO

With simulated full-load enrichment: 4.0 ... 6.0 vol. % CO

(Jump Term. 3 and Term. 18 on the throttle-valve switch plug.)

For settings for ignition, valve clearance, and other engine data, see the Equipment and Auto Data Microfiche card.





**ELECTRICAL TERMINAL DIAGRAM** from 3.84 until 7.85

- |                              |                                  |
|------------------------------|----------------------------------|
| 1 = Control-unit plug        | 5 = Pump relay                   |
| 2 = Hot-wire air-mass sensor | 6 = Test connection              |
| 3 = Main relay               | 7 = Pump fuse                    |
| 4 = Pressure-sensing switch  | 8 = Ground terminal output stage |

- |                             |
|-----------------------------|
| 9 = Throttle-valve switch   |
| 10 = Temperature sensor II  |
| 11 = Sensor ground terminal |
| 12 = Auxiliary-air device   |

- |   |
|---|
| 13 = Solenoid-operated injection valves |
| 14 = Electric fuel pump                 |
| 15 = Battery                            |

**A12**

Electrical terminal diagram

Saab

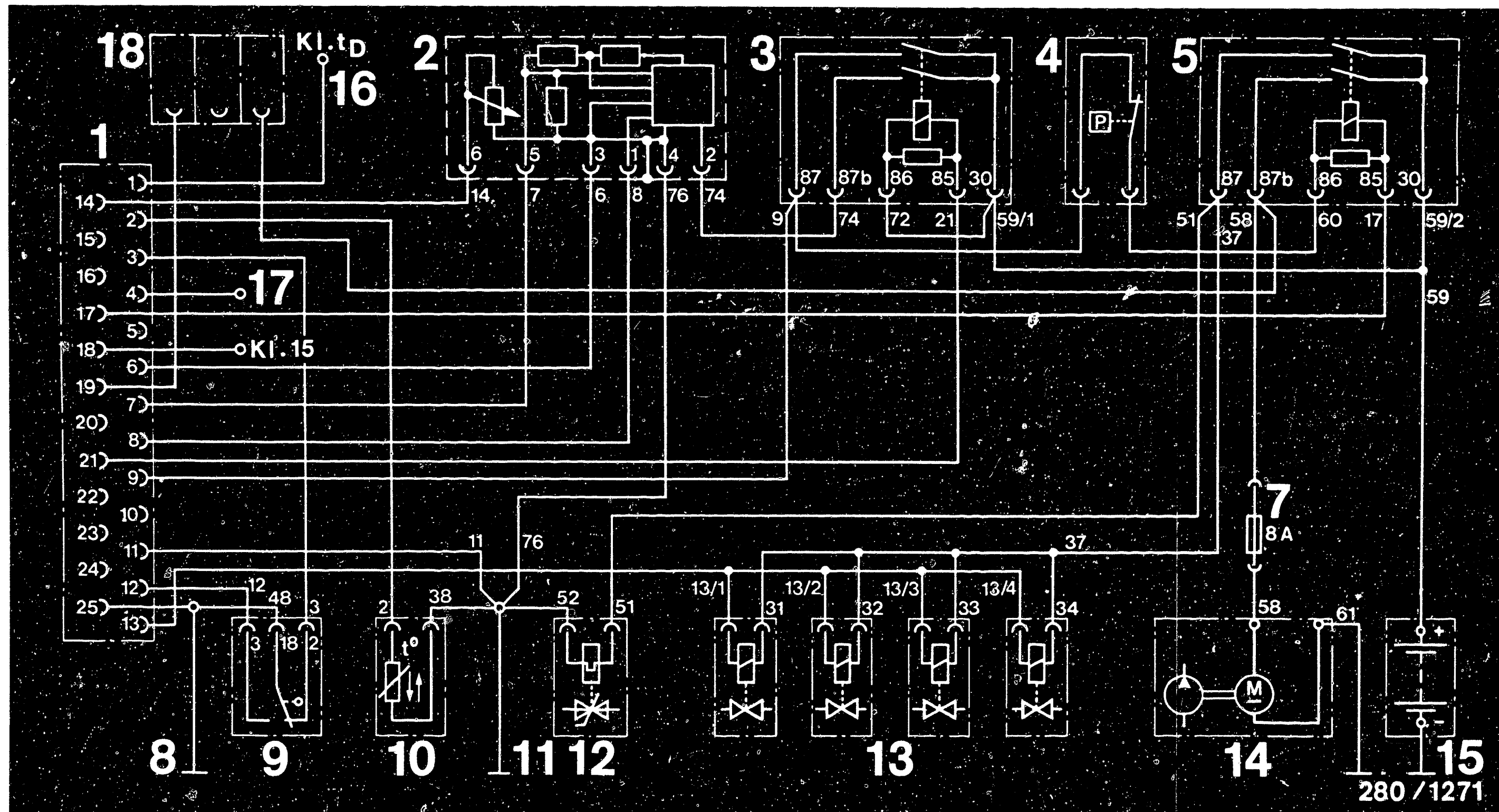


**A13**

Electrical terminal diagram

Saab





# ELECTRICAL TERMINAL DIAGRAM from 8.85

- |                              |                                  |
|------------------------------|----------------------------------|
| 1 = Control-unit plug        | 7 = Pump fuse                    |
| 2 = Hot-wire air-mass sensor | 8 = Ground terminal output stage |
| 3 = Main relay               | 9 = Throttle-valve switch        |
| 4 = Pressure-sensing switch  | 10 = Temperature sensor II       |
| 5 = Pump relay               | 11 = Sensor ground terminal      |

- |   |
|---|
| 12 = Auxiliary-air device               |
| 13 = Solenoid-operated injection valves |
| 14 = Electric fuel pump                 |
| 15 = Battery                            |

- |   |
|---|
| 16 = To ignition trigger box term. 7 ( $t_0$ ) via ignition booster relay |
| 17 = Air conditioner (where present and time-lag relay plugged)           |
| 18 = Test connection  |

**A14**

Electrical terminal diagram

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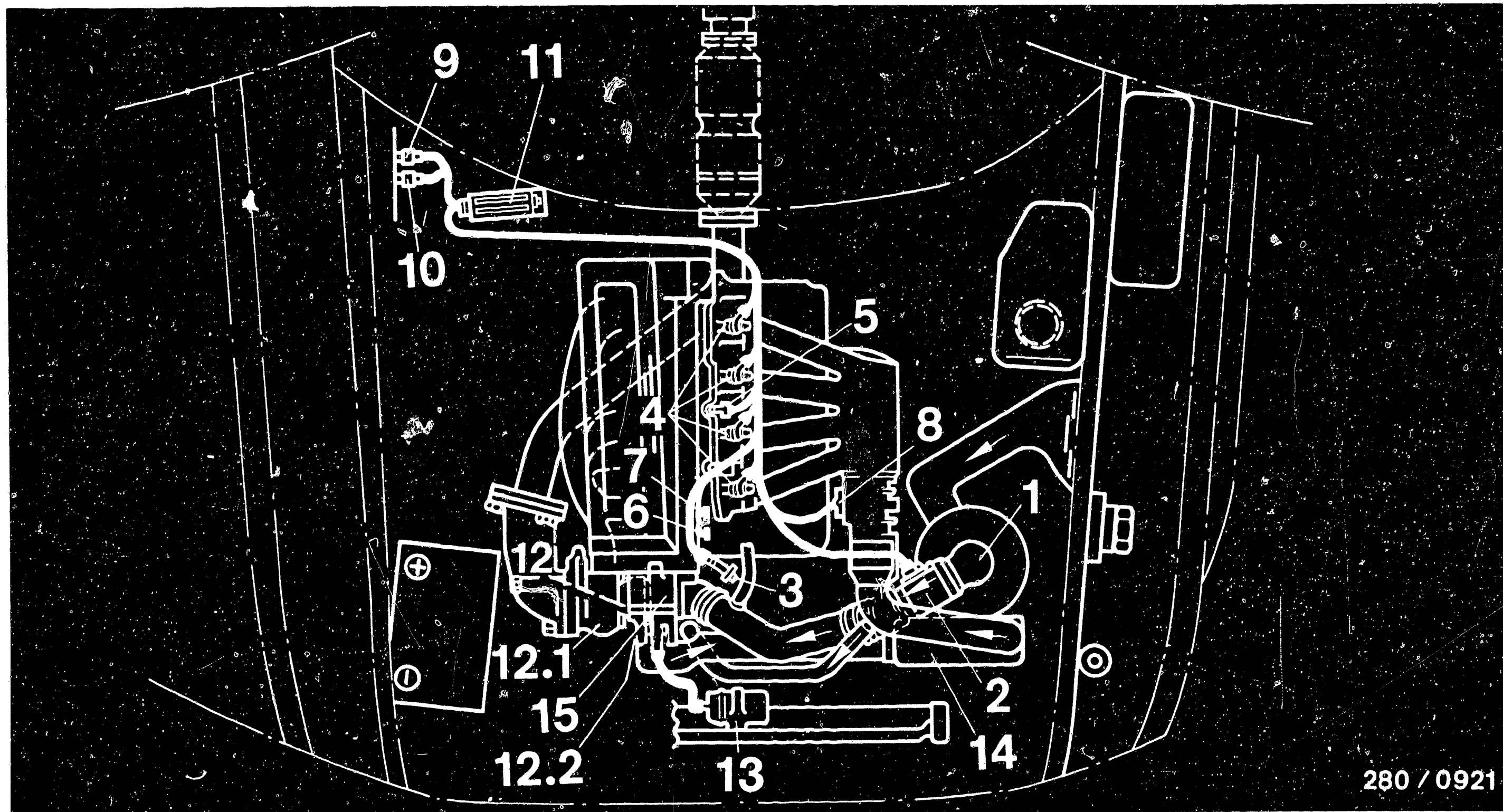
**A15**

Electrical terminal diagram

Saab







280 / 0921

# DIAGRAM OF ELECTRICAL LEADS

- 1 = Air filter
- 2 = Hot-wire air-mass sensor
- 3 = Auxiliary-air device
- 4 = Solenoid-operated fuel-injection valves

- 5 = Temperature sensor II (engine)
- 6 = Ground terminal, sensors
- 7 = Output stage ground terminal
- 8 = Throttle-valve switch

- 9 = Main relay
- 10 = Pump relay
- 11 = Control unit plug
- 12 = Exhaust-gas turbo-charger

- 12.1 = Turbine
- 12.2 = Compressor
- 13 = Ignition coil
- 14 = Charge-air cooler
- 15 = Ignition distributor

**A16**

Electrical lead diagram

Saab

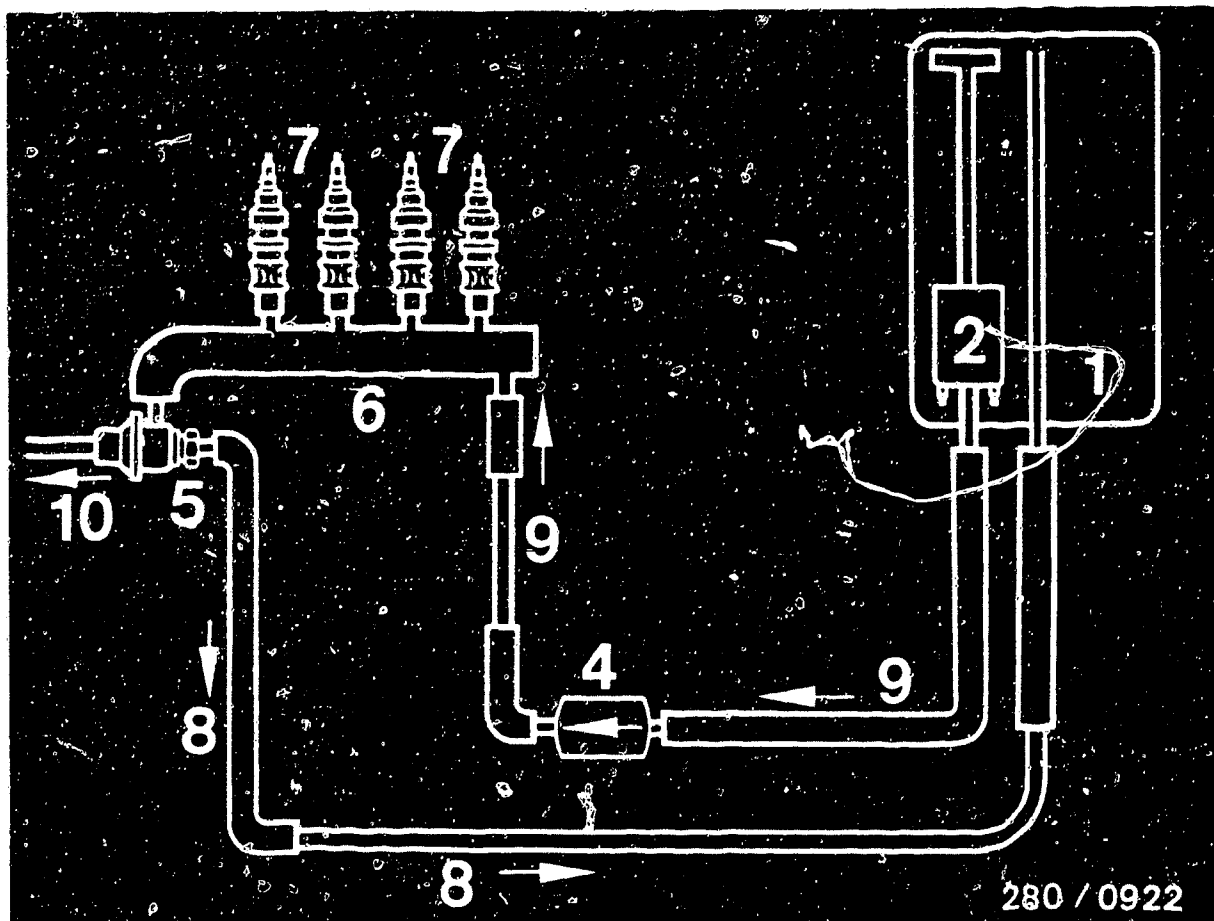


**A17**

Electrical lead diagram

Saab



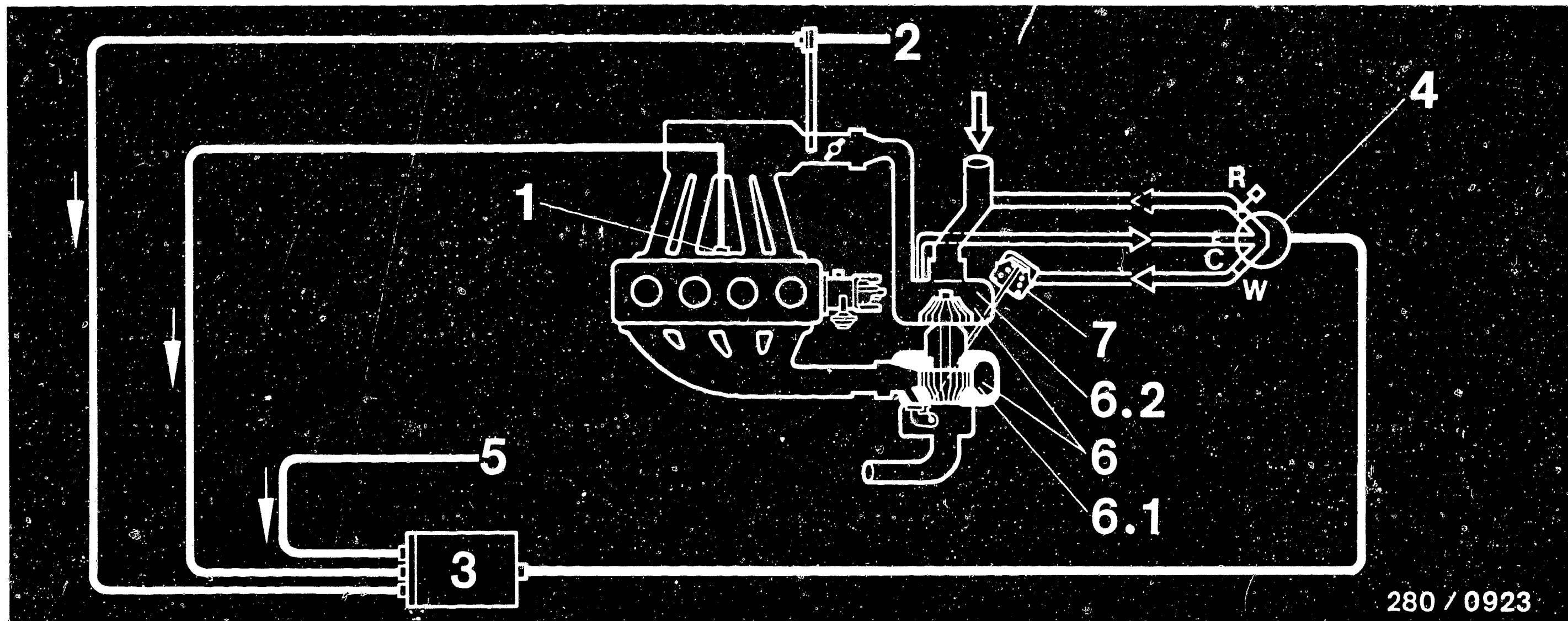


280 / 0922

# DIAGRAM OF FUEL LINES

- 1 = Fuel tank
- 2 = Electric fuel pump (in the tank)
- 4 = Fuel filter
- 5 = Pressure regulator
- 6 = Fuel distribution pipe
- 7 = Solenoid-operated fuel-injection valves
- 8 = Fuel return line
- 9 = Fuel delivery line
- 10 = To the intake manifold





280 / 0923

# OVERVIEW DIAGRAM OF THE KNOCK CONTROL (APC-SYSTEM) AND THE EXHAUST GAS TURBOCHARGER

— Electrical leads	1 = Knock sensor	4 = Solenoid-operated valve	6.1 = Turbine rotor
— Air hose	2 = Pressure sensor	5 = Engine speed information	6.2 = Compressor rotor
	3 = Control unit	6 = Exhaust-gas turbocharger	7 = Wastegate

**Operation:** A knock sensor (1) reacts to the engine load ratio (knock tendency) and sends an electrical signal to the control unit (3), which at the same time is receiving electrical signals from a pressure sensor (II) and from the ignition system (engine speed). In this control unit (3), these electrical signals are processed and transmitted as electrical pulses to a solenoid-operated valve (4), which in turn controls the charge-air pressure. When the solenoid-operated valve (4) is closed, the full pressure from the intake manifold is present at the wastegate (7). The wastegate (7) then opens and supplies a low charge-air pressure (depending on the basic setting). When the solenoid-operated valve (4) is open, the pressure is let off below the throttle setting via a hose on the inlet end of the compressor. As a result, there is no pressure at the wastegate, the wastegate closes, and a high charge-air pressure is thus produced.

**A19**

Knock control (APC-System)

Saab

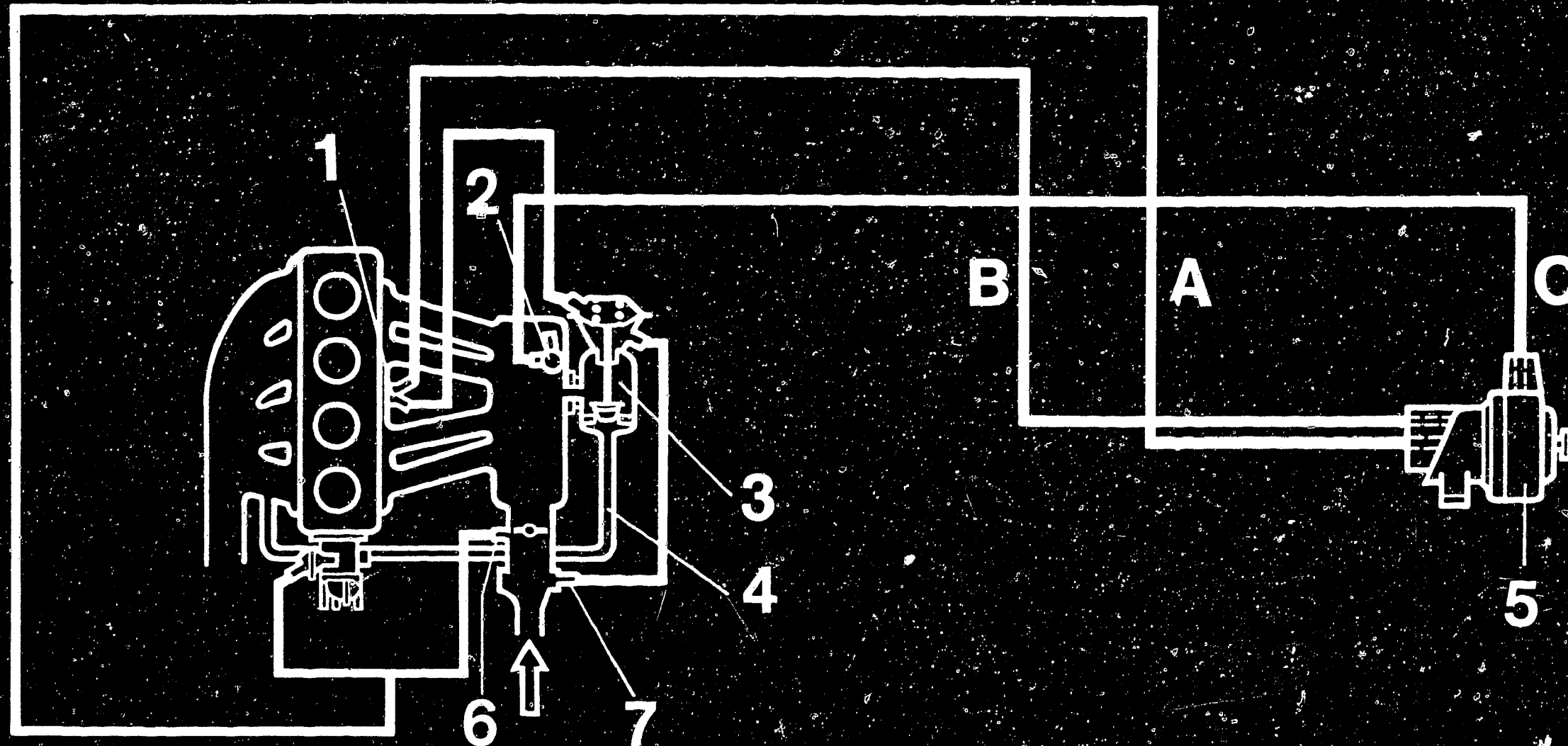


**A20**

Knock control (APC-System)

Saab





280 / 0953

# EXHAUST GAS RECIRCULATION

- 1 = Thermostatic valve
- 2 = Vacuum connection on intake manifold
- 3 = Exhaust-gas recirculation valve
- 4 = Exhaust-gas recirculation line
- 5 = Signal converter

- 6 = Vacuum connection on throttle valve (shared with ignition-timing adjustment)
- 7 = Vacuum connection before throttle valve

## Identification of hose connections

- A = To the throttle-valve housing (1) (Ignition-timing adjustment)
- B = Via the thermostatic valve to the exhaust-gas recirculation valve (spring end)
- C = To the intake manifold (at the brake servo-assist unit)

The exhaust-gas recirculation system includes the exhaust-gas recirculation valve, which opens both under vacuum and under overpressure, a signal converter, which directs the opening behavior of the exhaust-gas recirculation valve, and a thermostatic valve, which switches off the vacuum when engine temperatures are less + 20° C.

**A21**

Exhaust-gas recirculation

Saab



**A22**

Exhaust-gas recirculation

Saab



## TEST EQUIPMENT AND TOOLS

Description	Designation	Part no.
Universal test adapter	ETT 018.01	0 684 101 801
Adapter cable		1 684 463 141
Test cable		1 684 463 093
Motortester	e.g. MOT 002.00	0 684 000 200
	MOT 300	0 684 000 300
	MOT 400	0 684 000 400
Exhaust-gas tester	e.g. ETT 008.00	0 684 100 800
Calibrated infrared	ETT 008.04	0 684 100 804
exhaust-gas tester	or Ett 008.05	0 684 100 805
Ignition coil and condensor tester	EFAW 106A	0 681 100 001
Spark gap	EF 1177/7	1 684 531 000
Solenoid-operated injection valve		0 280 150 706
Parts set for solenoid-operated injection valves		1 287 010 704
Silicon assembly grease for solenoid-operated injection valves	Ft 2 v 1	5 700 080 125

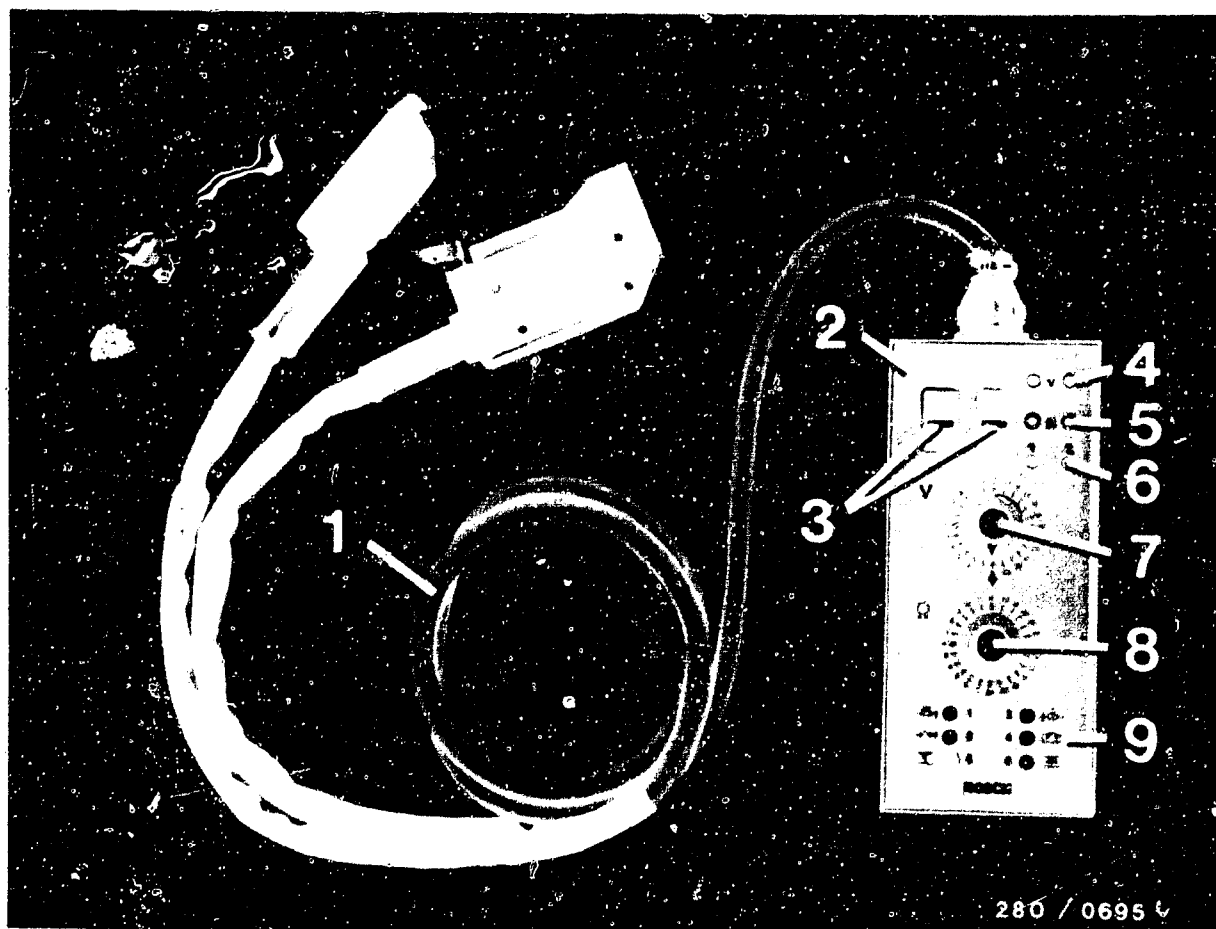


## Test equipment and tools (continued)

Description	Designation	Part no.
● Pressure gauge	Grade 1.0 ... 6 bar 0.1 bar gradation	1 687 231 154
● Pressure tester (fuel) Pressure-testing device or pressure-testing device (no longer available) Connecting piece		KDJE-P 100  KDEP 1034 KDJE-P100/14
● Pressure-testing device (air) - may be available in diesel workshop Pressure gauge	Grade 1 0.1 ... 1.6 bar gauge pressure Commercially available, e.g. Wika co.	No. 4184
● Three-way lead		KDJE-P100/13
Electric tester or multitester	e.g. ETE 014.00  e.g. Philips co. PM 2517 X e.g. Misco co. Master 50 K e.g. Fluke co.	0 684 101 400

Use a suitable commercially-available tool for removing and replacing the idle-CO anti-tamper device of the air-mass sensor.





● Universal test adapter with adapter cable for LH-Jetronic

- 1 = Adapter lead (Part No.: 1 684 463 141)
  - 2 = Universal test adapter (Part No. 0 684 101 801)
  - 3 = Test wells (for motortester)
  - 4 = Test sockets (for measuring voltage)
  - 5 = Test sockets (for measuring resistance)
  - 6 = Test sockets (for dwell angle tester)
  - 7 = "Volt" program switch
  - 8 = "Ohm" program switch
  - 9 = Buttons
- Buttons 1 and 2 : Temperature sensors, cold and warm
- Buttons 3 and 4 : Buttons for ground or voltage supply
- Buttons 5 and 6 : Simulation of idle or full load

### Connection

The picture shows the two test set-ups in conjunction with the universal test adapter. From top to bottom.

- Test set-up with a motortester (1) (optional)
  - Test set-up of universal test adapter (8) with LH adapter lead (13)
  - Test set-up with a multimeter (14) (optional).
- 
- Connect universal test adapter (8).
  - Connect LH adapter lead (13) to universal test adapter.
  - Disconnect control-unit plug (9) of Jetronic wiring harness from control unit and connect to wiring-harness plug (10) of adapter lead.
  - Connect control-unit plug (11) of adapter lead to control unit (12). (Please follow instructions in the individual test steps).

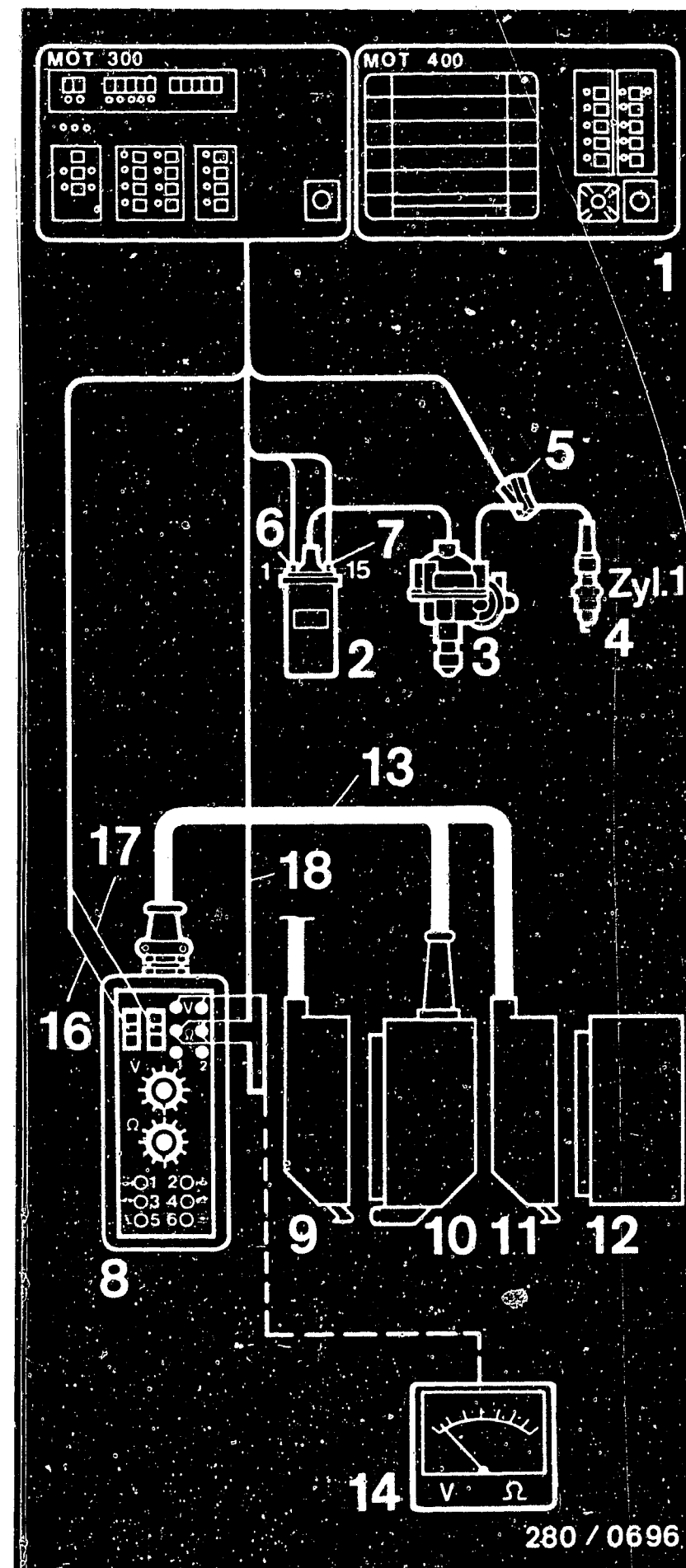
### Test set-up for measuring with a motortester (1)

- Inductive clamp-on pickup (5) over ignition cable of cylinder 1 (4) (near distributor) (3).
- Red clamp (16) to red connection terminal
- Black clamp (17) to black connection terminal
- Resistance measuring lead (18) with red and black test prods to blue sockets.

### Test set-up for testing with a multimeter (14) with $R_i = \text{min. } 20 \text{ k}\Omega/\text{V}$

- Resistance measurement  
Multimeter (14) at setting  $\Omega$  and plug the measuring lead into the connections for resistance measurement, and plug the measuring leads on the universal test adapter into the blue test sockets.
- Voltage measurement  
Multimeter (14) at setting V and plug the measuring leads into the connections for voltage measurement, and plug the measuring leads on the universal test adapter into the red and black test sockets. (Note polarity).

Caution: Connect and disconnect the universal test adapter only with the ignition off.



**B2**

Test equipment and tools

Saab



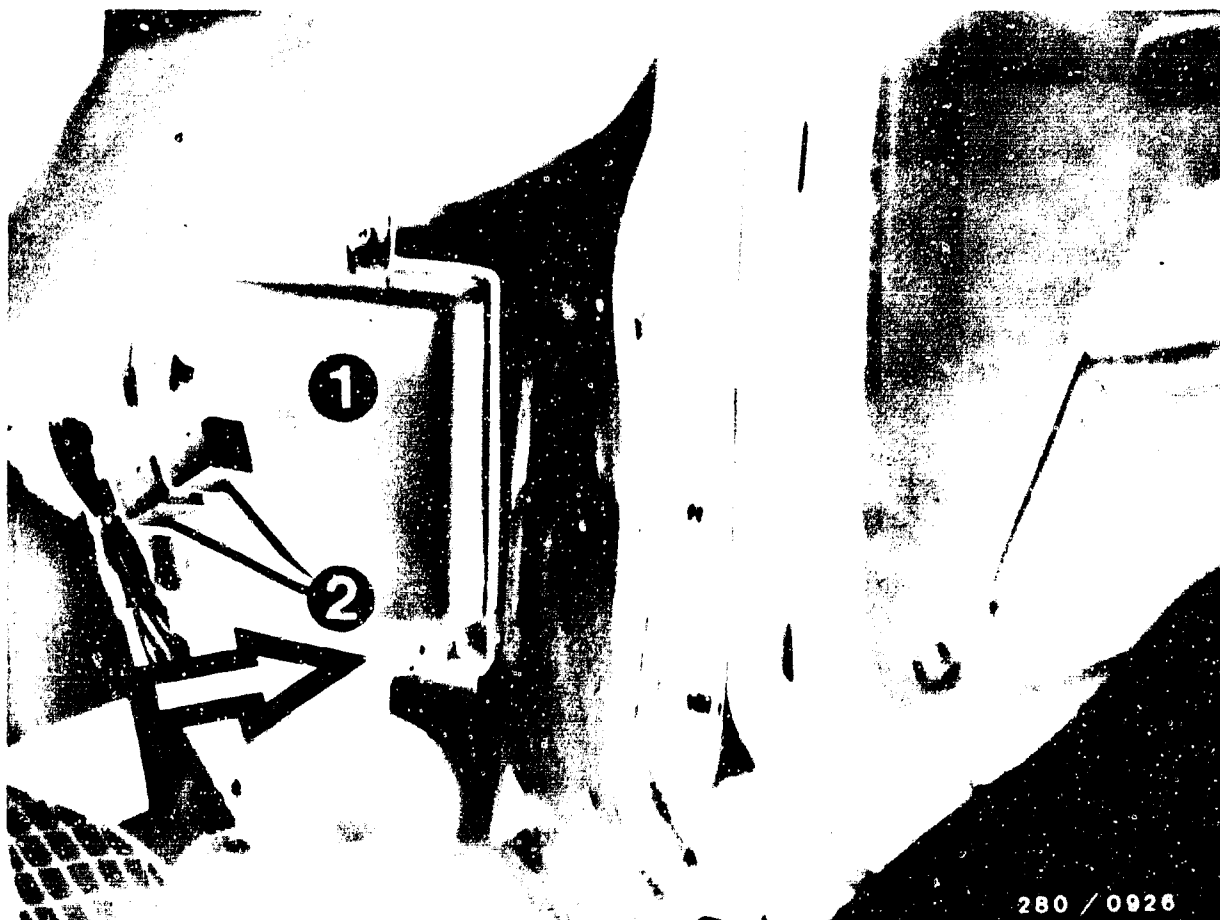
**B3**

Test equipment and tools

Saab







1 = Control unit

2 = Main and pump relays

To connect the universal test adapter, unplug the control unit plug (25-pin). To do this, press the detent in the direction shown by the arrow.

#### INSTALLATION POSITION OF COMPONENTS

Indication of installation position is always given looking in the direction of forward vehicle travel.

#### Control unit:

The control unit is on the right in the front passenger's footwell, behind the carpeting.





Installation position of the components (continued)

- |   |  |  |
|---|--|--|
| 1 = Temperature sensor II (engine), blue plug | 4 = Throttle-valve switch  | 7 = Pressure regulator                     |
| 2 = Ground terminals                          | 5 = Hot-wire air-mass sensor   | 8 = Solenoid-operated fuel-injection valve |
| 3 = Auxiliary-air device                      | 6 = Fuel filter as of 8.85 located under vehicle near rear axle on the right |  |

**B5**

Installation position of the components

Saab

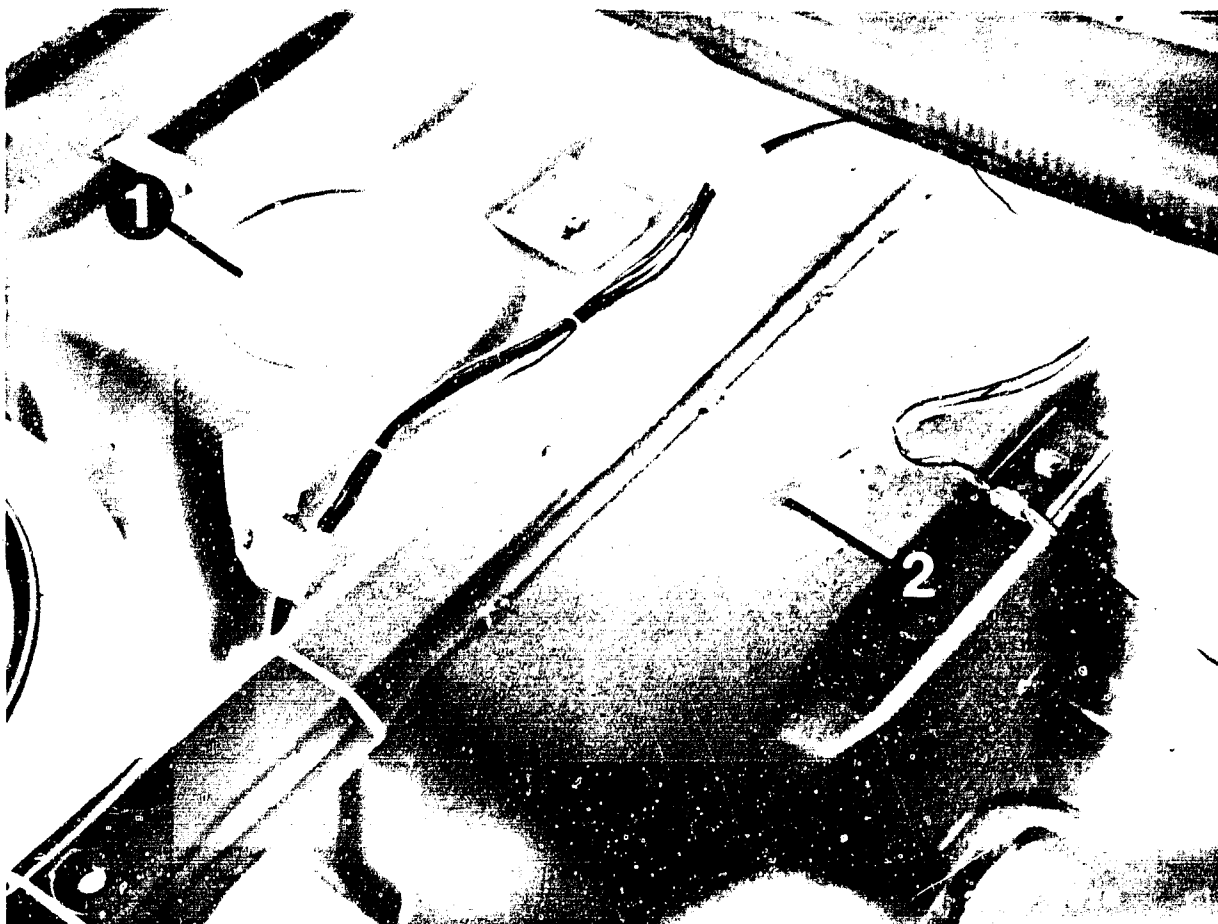


**B6**

Installation position of the components

Saab





Installation position of the components (continued)

- 1 = Electric fuel pump (under the cover)
- 2 = Tank sensor

The pressure-sensing switch is located under the dashboard.

Control unit for knock control: below rear seat,  
as of 8.85 in front on  
left fender.

Solenoid-operated valve: near the ignition coil.

Wastegate: on the turbocharger.

Pressure sensor: near the fuel filter.



## IMPORTANT GENERAL INSTRUCTIONS

- Never start the engine unless the battery is firmly connected.
- Jumping for start with more than 16 V or using a quick-charger is not allowed!
- Never disconnect the battery from the vehicle electrical system while the engine is running.
- Disconnect the battery from the vehicle electrical system when quick-charging it.
- The control unit is to be removed at temperatures above +80°C (paint-drying ovens).
- Make certain all connecting plugs on the wiring harness are properly seated.
- Never unplug or plug in the control unit plug when the ignition is switched on.
- When checking the compression pressure, interrupt the power supply by disconnecting the main relay. That breaks the power supply for the L-Jetronic (LH-Jetronic), and thus also for the fuel-injection valves. This prevents unwanted fuel injection. Unplug the ignition trigger box plug.
- The LH-control unit must be taken out during electrical welding (e.g. spot welding).
- When installing an alarm system, follow the instructions on microfiche card SIS-ALL-500.
- To use the trouble-shooting below, it is assumed that the engine is O.K. and that the ignition has been adjusted correctly. The electrical system must be checked and if need be repaired.
- In order to be able to carry out the testing described in these instructions and to evaluate the components, one should know the L-Jetronic and how it works. This operation and the construction of the L-Jetronic system in its essential characteristics are described in Technical Information VDT-I 987 722 010. The LH-Jetronic variant is described in Technical Information VDT-U-1/1 En as well as in Technical Bulletin, New Product VDT-I-280/4 of 10.1983 and VDT-I-280/7 of 12.83.



## TROUBLE-SHOOTING CHARTS

The purpose of the trouble-shooting charts below, when used with the universal test adapter and adapter lead (1 684 463 141) and other suitable test equipment, is to make it possible for workshop employees to identify quickly the causes of defects on the LH-Jetronic. A choice can be made between the following procedures, depending on the amount of training and experience the mechanic has:

- Detailed, step-by-step trouble-shooting chart

For employees with little experience and practice on vehicles having the LH-Jetronic. Entry in accordance with the customer complaint leads in each instance to a complete trouble-shooting program.

**C3**

- Targeted trouble-shooting chart leading directly to the cause of the defect

For trained and experienced employees having a greater amount of practice on vehicles with the LH-Jetronic. Entry according to the customer complaint leads at one's option to a specific component within the trouble-shooting program.

**C5**

Both trouble-shooting charts start with checking the electrical/electronic portion of the LH-Jetronic using the universal test adapter and the adapter lead.

With these, the electrical operation of the wiring harness and the components connected to it are checked in a short time, and defects are identified.

When no defect has been found using the universal test adapter, the fuel pressure test must be run.

When no defects are found here either, it is necessary to continue with either the detailed or the targeted trouble-shooting chart.

**C1**

Trouble-shooting charts

Saab



**C2**

Trouble-shooting charts

Saab



Detailed, step-by-step trouble-shooting chart for the complete trouble-shooting program

- Electrical test with the universal test adapter, adapter lead 1 684 463 141, and a motortester or multimeter

This test must be put at the start of the testing program and run from start through to end (Coordinates C9...E9).

- Fuel pressure test using pressure gauge

This test absolutely must follow testing with the universal test adapter and be run from start through to end (Coordinates C9...E9).

- Trouble-shooting according to customer complaints (defect symptom)

The table below lists possible defect symptoms and, next to them in the column at the right, the initial coordinates for the pertinent detailed trouble-shooting program. That program consists of test steps in a proper order for all individual components of the LH-Jetronic. If, after completion of the trouble-shooting program for one assumed defect, the problem has not been identified and corrected, a new program must be determined using a new defect symptom, and that program must be worked through.

<u>Customer complaints (Defect symptoms)</u>	<u>Electrical test with universal test adapter</u>	<u>Fuel pressure test using pressure gauge</u>	<u>Trouble-shooting program</u>
1. Starting motor turns, engine does not start or starts only with difficulty	C 9	E 10	F 13
2. Engine starts and then dies	C 9	E 10	G 3
3. Rough idle or incorrect idle speed	C 9	E 10	G 15
4. Poor throttle take-up	C 9	E 10	H 19
5. Engine missing in all driving conditions	C 9	E 10	J 11
6. Poor mileage	C 9	E 10	K 13
7. Insufficient max. power or max. driving speed	C 9	E 10	L 7
8. Idle speed and CO-level too high or too low	C 9	E 10	M 1

**C3**

Trouble-shooting

Saab



**C4**

Trouble-shooting

Saab



# Targeted trouble-shooting program leading directly to the cause of the defect, for components within the trouble-shooting program

- Electrical test with the universal test adapter, adapter lead (1 684 463 141) and a motortester or multimeter

The test with the universal test adapter must be put at the start of the testing program and be run from start through to end (Coordinates C9...E9).

- Fuel pressure test using pressure gauge

The fuel pressure test absolutely must follow the test with the universal test adapter and be run from start through to end (Coordinates E10...F11).

- Trouble-shooting according to customer complaint

The table below lists various defect symptoms, and in each instance several possible causes of the defect. The cross-reference field indicates the initial coordinates for the test step on the individual component of the LH-Jetronic involved. If, on completion of testing of the individual components, the problem has not been identified or corrected, a new defect symptom must be determined.

## Customer complaints (defect symptoms)

Symptoms (correct symptoms)								
1. Starting motor turns, engine does not start or starts only with difficulty								
2. Engine starts and then dies								
3. Rough idle or incorrect idle speed								
4. Poor throttle take-up								
5. Engine missing in all driving conditions								
6. Poor mileage								
7. Insufficient max. power or max. driving speed								
8. Idle speed and CO-level too low or too high								
<u>Cause</u> (component defect)								
C 9	C 9	C 9	C 9	C 9	C 9	C 9	C 9	Defect in the electrical system. Test with universal test adapter
E10	E10	E10	E10	E10	E10	E10	E10	Defects in the fuel supply: (Check main and pump relays, pump fuse, in-tank electric fuel pump, fuel pressure, and pressure regulator. Fuel pressure does not remain constant.) Non-return valve leaking.
F19	G5	H1	J1					Auxiliary air-device is not opening
		H1					M3	Auxiliary air-device is not closing
F21	G11		J3	K5	L1	L21	M13	Hot-wire air-mass sensor
				J19				Engine coughing on overrun
F23								Hot start

**C5**

Trouble-shooting

Saab



**C6**

Trouble-shooting

Saab



# Customer complaints (defect symptoms)

1. Starting motor turns, engine does not start or starts only with difficulty

2. Engine starts and then dies

3. Rough idle or incorrect idle speed

4. Poor throttle take-up

5. Engine missing in all driving conditions

6. Poor mileage

7. Insufficient max. power or max. driving speed

8. Idle speed and CO-level too low or too high

Cause (component defect)

F15							M5	Start control defective
G1	G13	H9	J5	K7		L23	M15	Leaking intake system
		H5		J23	K21			Solenoid-operated fuel-injection valves defective. Connect test lead, repair.
	G7				K15		M9	Solenoid-operated fuel-injection valves leaking
				J15		L13		Fuel delivery from electric fuel pump too low
						L15		Exhaust-gas turbocharger for knock control (APC-System) defective
		G17	H21	J19				Throttle-valve does not close, throttle-valve switch (adjustment)
						L9		Throttle valve is not opening completely
		G19	H23	J19				Setting of throttle valve damper
G1	G13	H9	J5	K7		L23		Open circuits in wiring harness and plug connections
		H11	J7	K9	L3		M17	CO-exhaust setting too rich, idle adjustment ) G19/M13 exhaust
		H11	J7	K9			M17	CO-exhaust gas setting too lean, idle adjustment ) gas recirculation (EGR)
				J13				Interference, missing, ground contact
				J17		L11		Control unit defective

C7

Trouble-shooting

Saab



C8

Trouble-shooting

Saab





# TEST CHART FOR THE UNIVERSAL TEST ADAPTER

With adapter lead 1 684 463 141 connected, LH-Jetronic in the vehicle Saab 900 Turbo (3.84 →)

- Before testing with the universal test adapter, check all multiple plug connections for loose contacts. Clean dirty or corroded plug contacts.
- Watch for sockets that have been shoved back. If need be, rebend the latching blade and press the socket into the plug housing as far as the stop. The latching blade will catch.
- Suspect breaks in leads at kinked or pinched locations.

Installation location of control unit: In the front passenger's footwell, at the bottom right on the A-pillar.

The periphery of the electrical system and, with a functional test, the LH-control unit as well are checked using the universal test adapter. Disconnect the control unit plug of the Jetronic wiring harness from the control unit and connect it to the adapter lead plug. Connect the free end of the adapter lead to the control unit. (The ignition must be switched off.) Connect a motortester to the universal test adapter to take measurements, and a multimeter for measuring voltage and resistance.

Caution! Because the adapter lead connections must continually be changed for checking the periphery and for the functional test, follow instructions in the test chart.

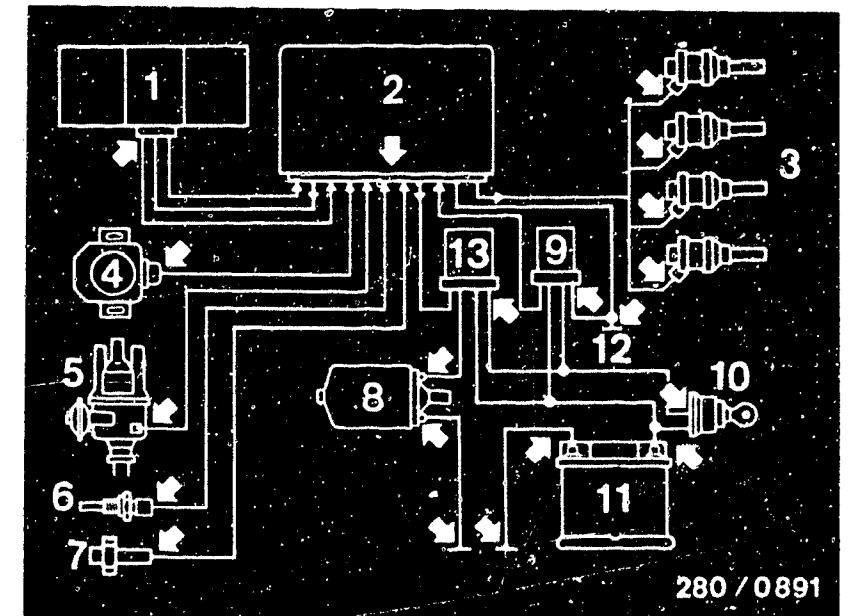
Individual test steps are selected using two program switches (one for measuring voltages, the other for measuring resistances). Each program switch has 24 test settings, but only some of them are assigned for the LH-Version. If a defect has been found in one of the tests, that test must be repeated when the defect has been corrected.

The testing with the universal test adapter must always be run completely.

Be absolutely certain to follow the instructions in the test chart!

- Resistances are measured in test steps 1...7. Put the motortester or multimeter at "measurement of resistance".
- Voltages during start or with ignition "ON" are measured in test steps 8 ... 13. Put the motortester or multimeter at "measurement of voltage".
- In test steps 14...19, tests with engine running.

Test specifications and instructions for operation of the universal test adapter are indicated in the test chart below.



Electrical plug-in connections (arrows)

- 1 = Hot -wire air-mass sensor
- 2 = Control unit
- 3 = Solenoid-operated fuel-injection valves
- 4 = Throttle-valve switch
- 5 = Ignition distributor
- 6 = Temperature sensor (engine)
- 7 = Auxiliary-air device
- 8 = Electric fuel pump
- 9 = Main relay
- 10 = Ignition lock
- 11 = Battery
- 12 = Central ground
- 13 = Pump relay

**C9**

Test chart for universal test adapter  
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**C10**

Test chart for universal test adapter  
Saab



## Prerequisites for correct test procedure

1. Start testing at test step 1.
2. The sequence of test steps must be maintained. The trouble-shooting indicated builds upon preceding trouble-shooting test steps.  
For example:  
Once the ground connection Term. 11 for the control unit has been checked in test step 1, that test is no longer repeated in further test steps.
3. If an incorrect value is shown in one of the test steps, that test step must be repeated upon correction of the defect.

### Caution!

Test steps 1 through 13: connect adapter lead to periphery only.

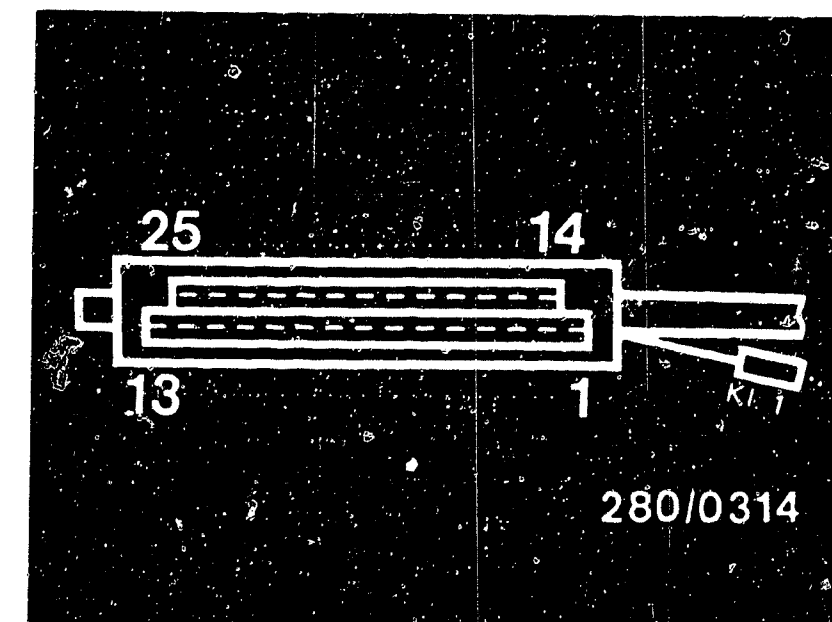
Test steps 14 through 19: connect adapter lead to control unit and periphery!

### Note:

A white border in the test steps below in the column "operation" shows which operation is to be changed from the preceding test step.



TEST STEP 1 (Plug in only control unit plug of the adapter lead!)			
Operation		Reading	Test on periphery
Program switch "V" in position	↓	Reading on the test equipment must be 1450 ... 3300 $\Omega$ at ambient temperature (+15°C ... + 30°C), and 280 ... 360 $\Omega$ with engine at normal operating temperature (+80°C).	Component: Temperature sensor II (engine)
Program switch "Q" in position	5		
Test equipment: Motortester or multimeter			Function: Resistance of control unit plug Term. 2 to the ground terminal for the sensors
Scale: x 10 $\Omega$		<div>yes</div> <div>no</div>	Malfunction: Resistance not within tolerance
Connection: Blue test sockets			
Operation in the vehicle: ----			
		Continue testing with next test step.	



Top view of control unit plug

- 1 = Temperature sensor II (water), blue plug  
2 = Ground terminal, sensors



#### Trouble-shooting:

To test, disconnect the control unit plug from the test adapter and if necessary, use a wiring diagram.

Measure resistance directly on the engine temperature sensor (blue plug).

At ambient temperature (+15°C ... +30°C): 1450 ... 3300  $\Omega$

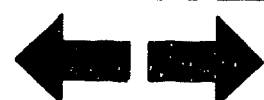
With engine at normal operating temperature (approx. +80°C): 280 ... 360  $\Omega$

Check the following leads with an ohmmeter for continuity (specified value approx. 0  $\Omega$ ):

- From control unit plug Term. 2 to temperature sensor II (engine) Term. 2.
  - Lead 38 from the temperature sensor II to the ground terminal for the sensors.
  - From the control unit plug Term. 11 to the ground terminal for the sensors.
- Eliminate contact resistances in the plug connections. It must not be possible to shove spring contacts back!
- If the resistance measured is not within tolerance, take out and replace the temperature sensor. (Tightening torque 20 Nm).

**C12**

Test chart for universal test adapter  
Saab



**C13**

Test chart for universal test adapter  
Saab



TEST STEP 2 (Plug in only control unit plug of the adapter lead!)			
Operation		Reading	Test on periphery
Program switch "V" in position	↓	Reading on the test equipment must be 0 ... 10 Ω.	Component: Output stage ground connection
Program switch "Ω" in position	6		
Test equipment: Motortester or multimeter		<div>yes</div> <div>↓</div> <div>Continue testing with next test step.</div>	<div>Function: Resistance from control unit plug Term. 25 to the output stage ground terminal</div> <div>Malfunction: Resistance not within tolerance</div>
Scale: x 1 Ω			
Connection: Blue test sockets			
Operation in vehicle: ----		no ↓	

#### Trouble-shooting:

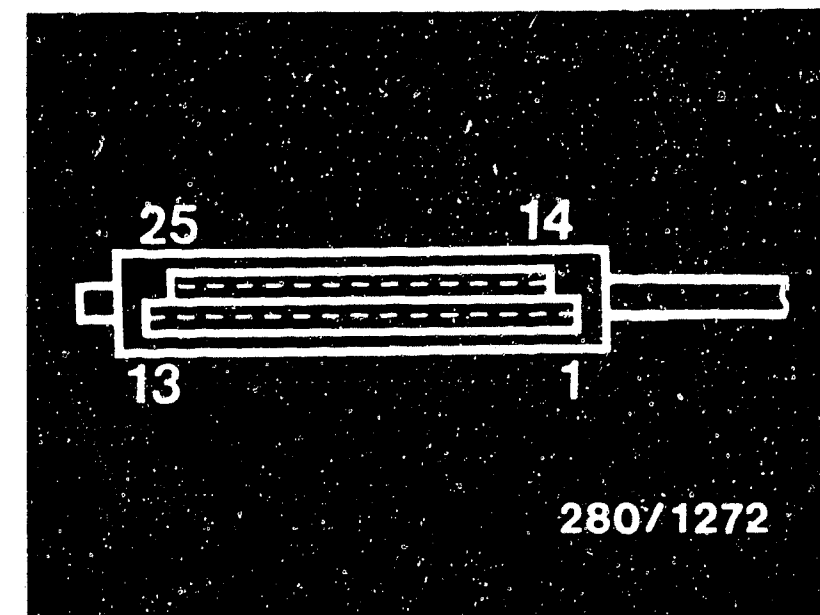
To test, disconnect the control unit plug from the test adapter and if necessary, use a wiring diagram.

Check the following leads with an ohmmeter for continuity (specified value approx. 0 Ω):

- From control-unit plug term. 25 to ground terminal output stage.

Release the ground screws. Clean the connection. Then tighten the screw again securely.

Eliminate contact resistances at the plug connection.



Top view of control unit plug

3 = Output stage ground terminal



**C14**

Test chart for universal test adapter  
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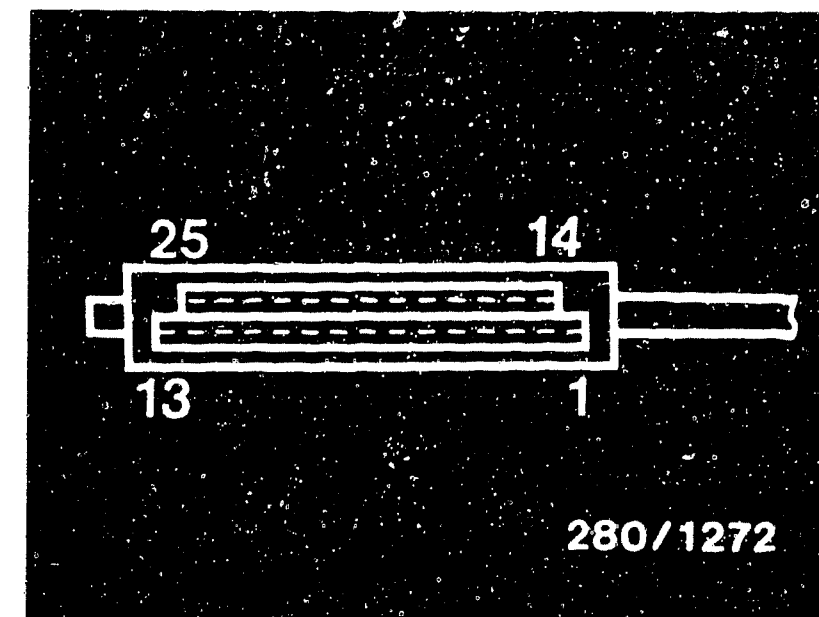


**C15**

Test chart for universal test adapter  
Saab



TEST STEP 3 N/A as of 8.84 (connect adapter cable to periphery!)			
Operation		Reading	Test on periphery
Program switch "V" in position	↓	The reading on the test equipment must be  0 ... 10 Ω.	Component: Ground connection of the ground terminal for the sensors
Program switch "Ω" in position	7		
Test equipment: Motortester or multimeter		yes	Function: Resistance from control unit plug Term. 5 to the ground terminal
Scale: x 1 Ω		↓	
Connection: Blue test sockets		no	
Operation in vehicle: ----		Continue testing with next test step.	
			Malfunction: Resistance not within tolerance



Top view of control unit plug

#### Trouble-shooting:

To test, disconnect the control unit plug from the test adapter and if necessary, use a wiring diagram.

Check the following leads with an ohmmeter for continuity  
(Specified value approx. 0 Ω):

- From the control unit plug Term. 5 to the ground terminal for the sensors.

Release the ground screws. Clean the connection. Then retighten the screw securely.

Eliminate contact resistances in the plug connections.

2 = Ground terminal, sensors



**C16**

Test chart for universal test adapter  
Saab



**C17**

Test chart for universal test adapter  
Saab



TEST STEP 4 (Plug in only control unit plug of the adapter lead!)			
Operation		Reading	Test on periphery
Program switch "V" in position	↓	Reading on the test equipment must be 6.80 ... 9.30 at ambient temperature (+15°C ... +30°C): and 7.00 ... 9.80 Ω with engine at normal operating temperature (+80°C). Remove jumper: reading must increase by approx. 50 Ω.	Component: Solenoid-operated fuel-injection valves 1, 2, 3, and 4 Auxiliary-air device
Program switch "Ω" in position	8		
Test equipment: Motortester or multimeter			Function: Resistance on the control unit plug Term. 13 to the ground terminal for the sensors.
Scale: x 1 Ω			
Connection: Blue test sockets		yes	Malfunction: Resistance not within tolerance
Operation in the vehicle: Disconnect plug from the auxiliary-air device and insert jumper in the connecting plug. Caution! After the test, remove the jumper and plug the plug back in.		no	
		Continue testing with next test step.	

#### Trouble-shooting:

To test, disconnect the control unit plug from the test adapter and if necessary, use a wiring diagram.

Check the following leads with an ohmmeter for continuity (specified value approx. 0 Ω):

- From the control unit plug Term. 13 to the solenoid-operated fuel-injection valve.
- From the solenoid-operated fuel-injection valves to the pump relay Term. 87.
- From the pump relay Term. 87 to the ground terminal, sensors (via lead 51 to the connecting plug for the auxiliary-air device, via a short-circuit jumper, and via lead 52 to the ground terminal, sensors).

Caution! The jumper must be removed after the test and the connecting plug plugged back in.

The resistance must rise by approx. 50 Ω. If not, the auxiliary-air device is defective.

Measurement of resistance on the solenoid-operated fuel-injection valve:

At ambient temperature (+15°...+30°C):

14.5...17.0 Ω

With engine at normal operating temperature (approx. +80°C):

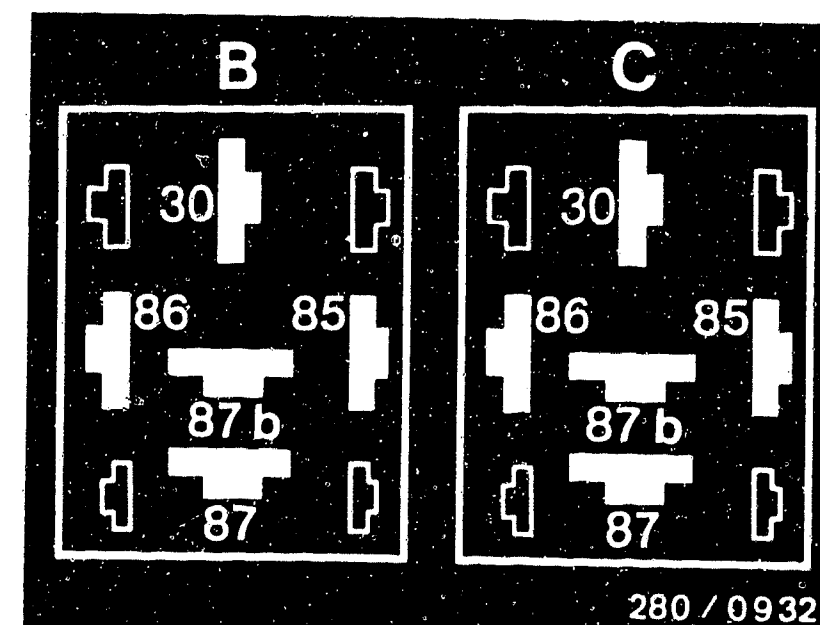
16.5...19.5 Ω

If reading is too high: the valve coil has an open circuit, or a valve plug has fallen off. Check seating of the plug blades. It must not be possible to shove spring contacts back.



Arrow = Short-circuit jumper on auxiliary-air device connection plug

Main relay (B) and pump relay (C), unplugged.  
Top view of sockets



C18

Test chart for universal test adapter  
Saab



C19

Test chart for universal test adapter  
Saab



Test step 4 (continued)

Installation position in the components

Solenoid-operated fuel-injection valves:

In the center of the engine compartment on the fuel distribution pipe.

Pump relay:

In the passenger compartment, at the bottom right in the front passenger's footwell, next to the LH-control unit.

Pump fuse:

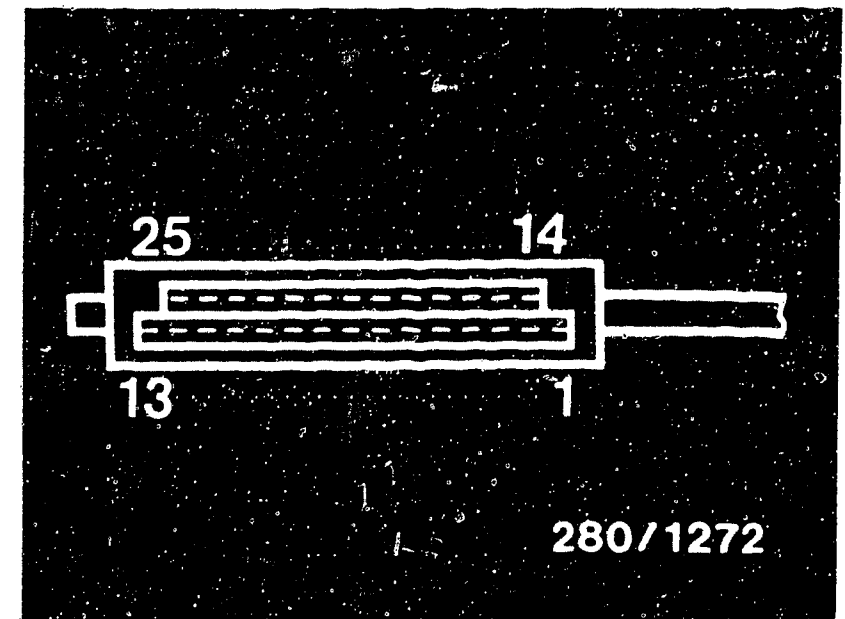
In the central fuse box in the engine compartment, on the fender at the left.  
No. 30.

Electric fuel pump:

In-tank pump (under the cover on the left in the trunk compartment).

Ground connection for the electric fuel pump:

In the trunk compartment.  
Central ground point under the cover at the center, near the rear-facing panel.



Top view of the control unit plug

**C20**

Test chart for universal test adapter  
Saab



**C21**

Test chart for universal test adapter  
Saab





TEST STEP 5 (Plug in only control unit plug of the adapter lead!)			
Operation		Reading	Test on periphery
Program switch "V" in position		The readings on the test equipment must be  $0 \dots 10 \Omega$ 1) $\infty \Omega$ 2) $\infty \Omega$ 3)  after <u>3...6 s</u> , the reading must be $0 \dots 10 \Omega$ .	Component: Throttle-valve switch (idle contact) and mechanical throttle-valve damper
Program switch "Ω" in position			
9			
Test equipment: Motortester or multimeter			Function: Resistance value on the control unit plug Term. 3 to the output stage ground terminal
Scale: x 1 Ω			
Connection: Blue test sockets		yes Continue test- ting with <u>next</u> test step.	no
Operation in the vehicle: Accelerator pedal in at rest pos.1) Press half way down on accel. 2) Release accelerator 3)			
			Malfunction: Resistance not within tolerance

#### Trouble-shooting:

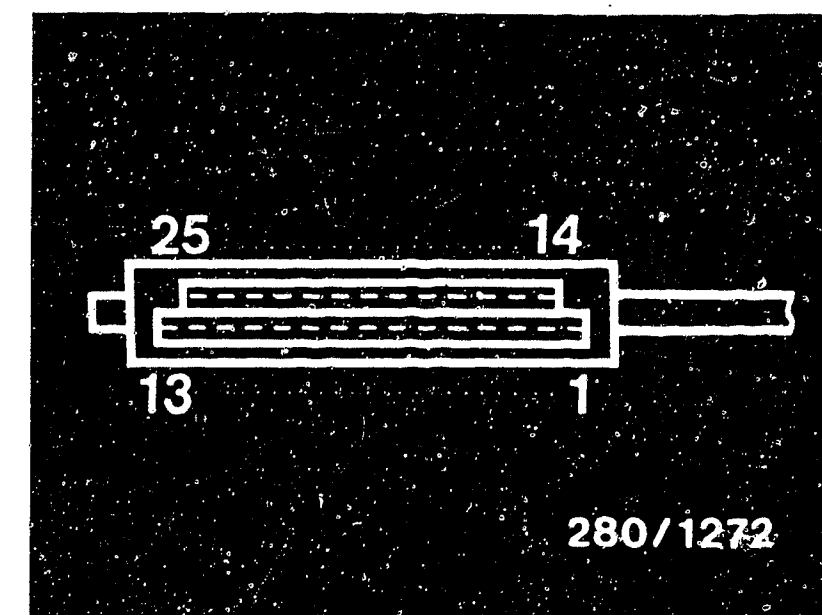
To test, disconnect the control unit plug from the test adapter and if necessary, use a wiring diagram.

Adjustment of the throttle valve switch: Release the fastening screws for the throttle-valve switch somewhat. Connect an ohmmeter to the throttle-valve switch between Term.2 and Term 18. Turn the throttle-valve switch a little to the left, after that to the right, until the idle contact closes. (The microswitch clicks audibly.) Reading approx.  $0 \Omega$ . Retighten the fastening screws. If reading is incorrect, take out and replace the throttle-valve switch. Checking setting: Pull on the accelerator linkage somewhat. The idle contact opens. (The microswitch clicks audibly.) Reading  $\infty \Omega$ .

Check the following leads with an ohmmeter for continuity (specified value approx.  $0 \Omega$ ):

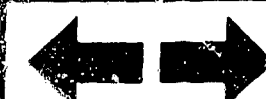
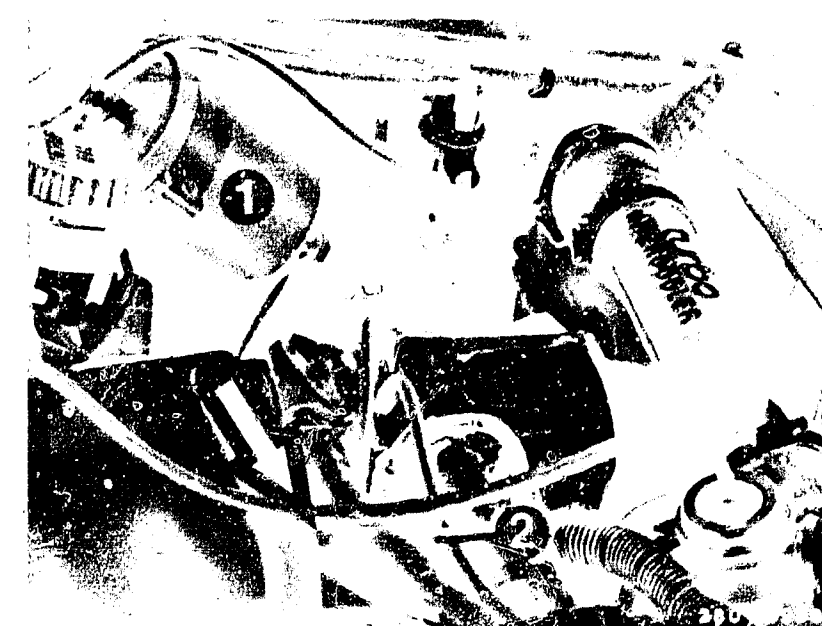
- From the control unit plug Term. 3 to the throttle-valve switch Term. 2.
- From the throttle-valve switch Term. 18 (lead 48) to the output stage ground terminal.
- It must not be possible to shove spring contacts back.
- Eliminate contact resistances in the plug connection.

Continued on D1/D2



Top view of control unit plug

- 1 = Fuel filter
- 2 = Throttle-valve switch
- Arrow = Fastening screws





## Test step 5 (continued)

### Mechanical throttle-valve damper (Dash pot)

#### Testing:

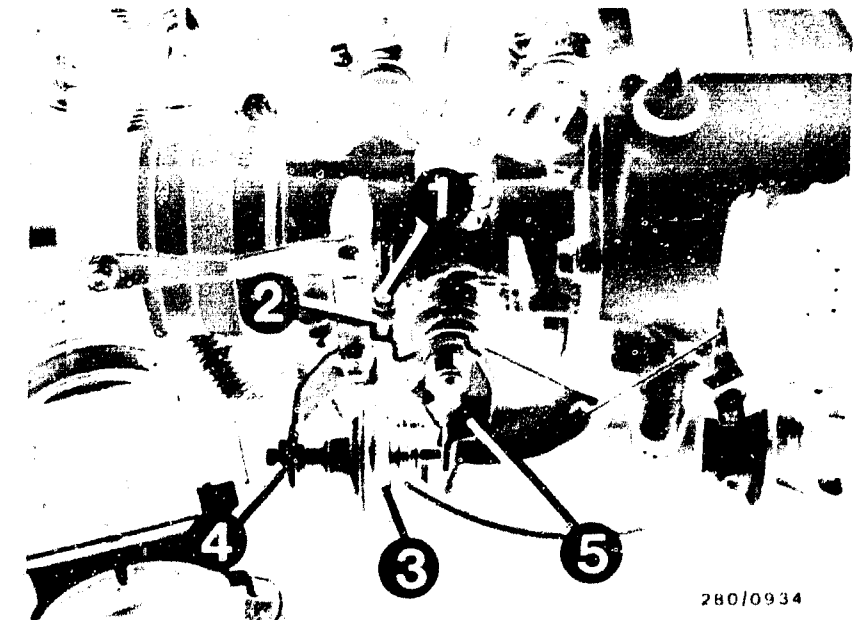
- Accelerator pedal in at rest position: Reading 0 ... 10  $\Omega$
- Press down on accelerator somewhat: Reading  $\infty$   $\Omega$
- Release the accelerator: Reading  $\infty$   $\Omega$

After approx. 3 ... 6 s the reading must drop off to 0 ... 10  $\Omega$ .

Is it operating O.K.? If not, adjustment:

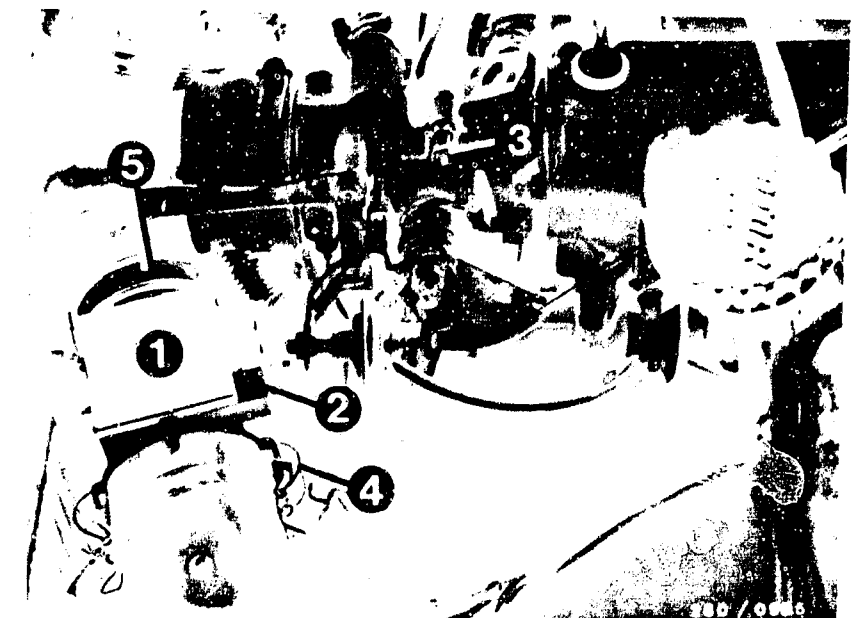
Restore the original condition of installation. (Connect the control unit.)

- Run the engine to normal operating temperature.
- Check idle speed 775...925 min<sup>-1</sup>.
- Release the locking nut on the throttle-valve damper.
- Increase engine speed to 2000 min<sup>-1</sup>.  
Adjust the throttle-valve damper in such a way that it touches the throttle-valve lever. (Turning throttle-valve damper toward the bracket → longer delay time).  
(Turning the throttle-valve damper away from the bracket → shorter delay time).
- Check the delay time.  
Increase the engine speed to 2000 min<sup>-1</sup>, and using a stopwatch, measure the time interval between releasing the accelerator pedal and reaching idle speed (775 ... 925 min<sup>-1</sup>). The delay time must be between approx. 3 ... 6 s.  
If not, take out and replace the throttle-valve damper.



- 3 = Throttle-valve damper
- 4 = Locking nut (for adjustment of the throttle-valve damper)
- 5 = Throttle-valve lever

- 3 = Idle-speed adjusting screw



**D1**

Test chart for universal test adapter

Saab




**D2**

Test chart for universal test adapter

Saab



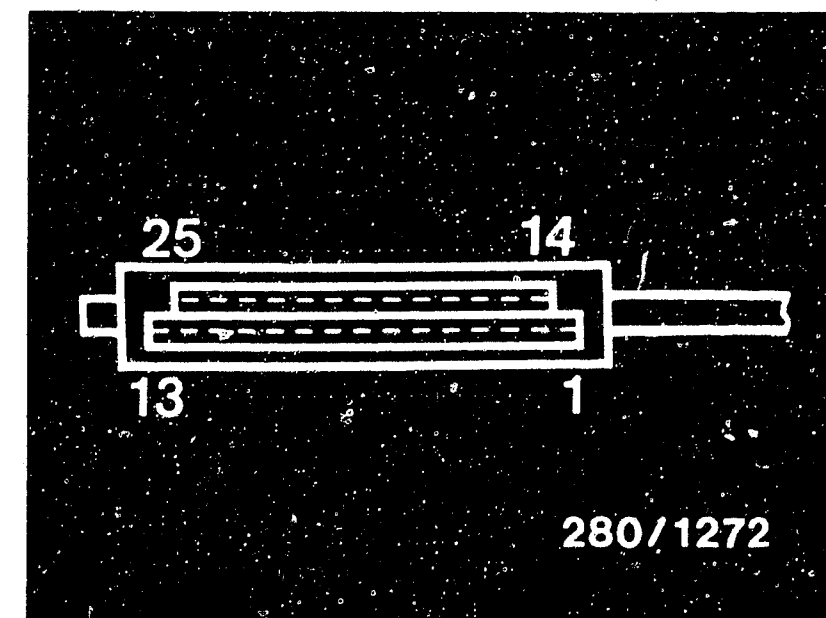
TEST STEP 6 (Plug in only control unit plug of the adapter lead!)				
Operation		Reading	Test on periphery	
Program switch "V" in position		Reading on the test equipment must be  0 ... 10 Ω.	Component: Throttle-valve switch (full-load contact)	
Program switch "Ω" in position				10
Test equipment: Motortester or multimeter		<div>yes</div> <div>no</div>	Function: Resistance on the control unit plug Term. 12 to the output stage ground terminal	
Scale: x 1 Ω				
Connection: Blue test sockets				Malfunction: Resistance not within tolerance
Operation in the vehicle: Accelerator pedal in full-load position (all the way down)				
		Continue testing with next test step.		

#### Trouble-shooting:

To test, disconnect the control unit plug from the test adapter and if necessary, use a wiring diagram.

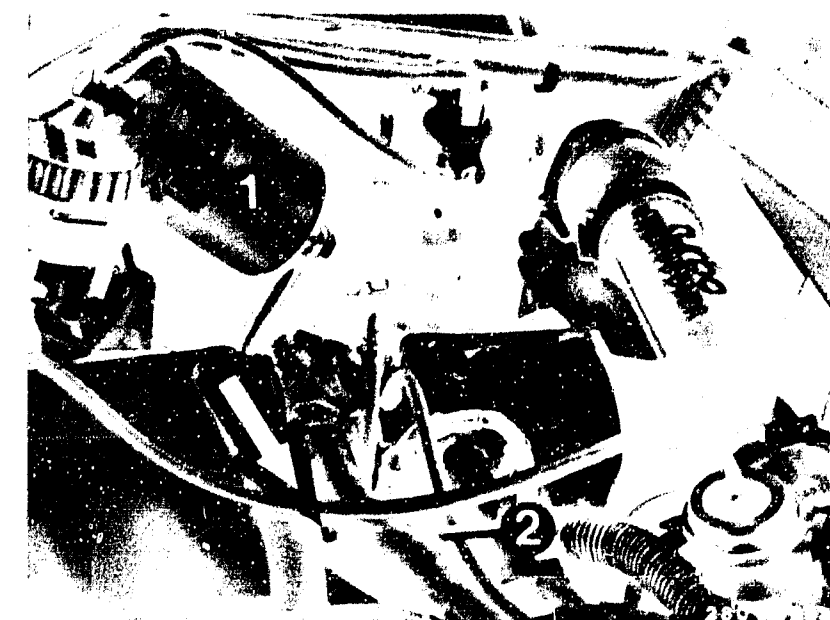
Check the following leads with an ohmmeter for continuity (specified value approx. 0 Ω):

- From the control unit plug Term. 12 to the throttle valve switch Term. 3.  
Eliminate contact resistances in the plug connections.
- It must not be possible to shove the spring contacts back.



Top view of control unit plug

1 = Fuel filter  
2 = Throttle-valve switch  
Arrow = Fastening screws



**D3**

Test chart for universal test adapter  
Saab



**D4**

Test chart for universal test adapter  
Saab



TEST STEP 7 (Plug in only control unit plug of the adapter lead!)			
Operation		Reading	Test on periphery
Program switch "V" in position	↓	Reading on the test equipment must be <u>150 ... 600 <math>\Omega</math>.</u>	Component: Potentiometer in the hot-wire air-mass sensor
Program switch " $\Omega$ " in position	21		
Test equipment: Motortester or multimeter		<div>yes</div> <div>↓</div> <div>Continue test- with next test step.</div>	Function: Potentiometer for adjustment of the idle mixture. Resistance on the control unit plug Term. 14 and Term. 6  Malfunction: Resistance not within tolerance
Scale: <span style="float: right;">x 1 <math>\Omega</math></span>			
Connection: Blue test sockets			
Operation in the vehicle: ----			
		no ↓	

#### Trouble-shooting:

To test, disconnect the control unit plug from the test adapter and if necessary, use a wiring diagram.

Check the following leads with an ohmmeter for continuity (specified value approx. 0  $\Omega$ ):

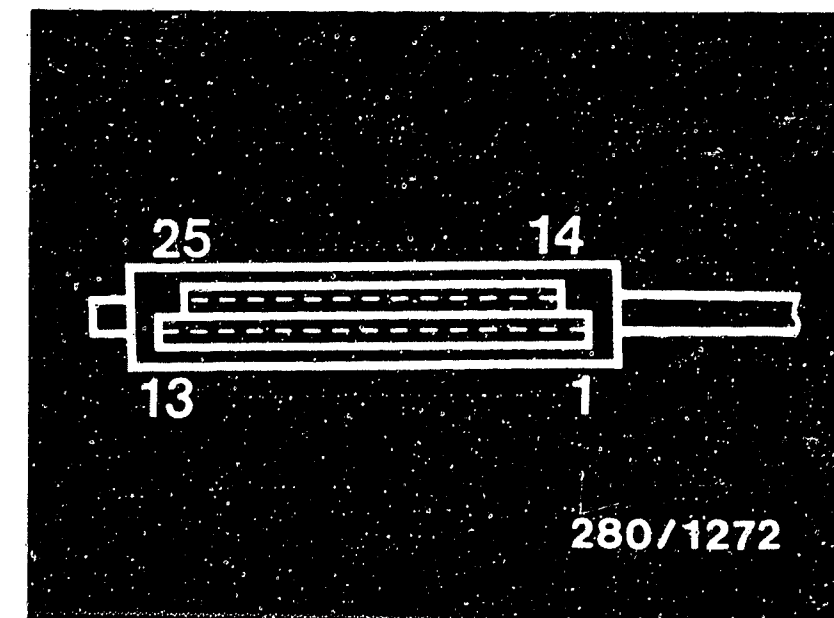
- From the control unit plug Term. 14 to the hot-wire air-mass sensor Term. 6.
- From the hot-wire air-mass sensor Term. 3 to the control unit plug Term. 6.

Measure the resistance directly on the hot-wire air-mass sensor between Term. 6 and Term. 3. Specified value 150 ... 600  $\Omega$ .

Set the resistance at 370 ... 390  $\Omega$ . If not possible, take out and replace the hot-wire air-mass sensor. CO setting must be checked afterwards.

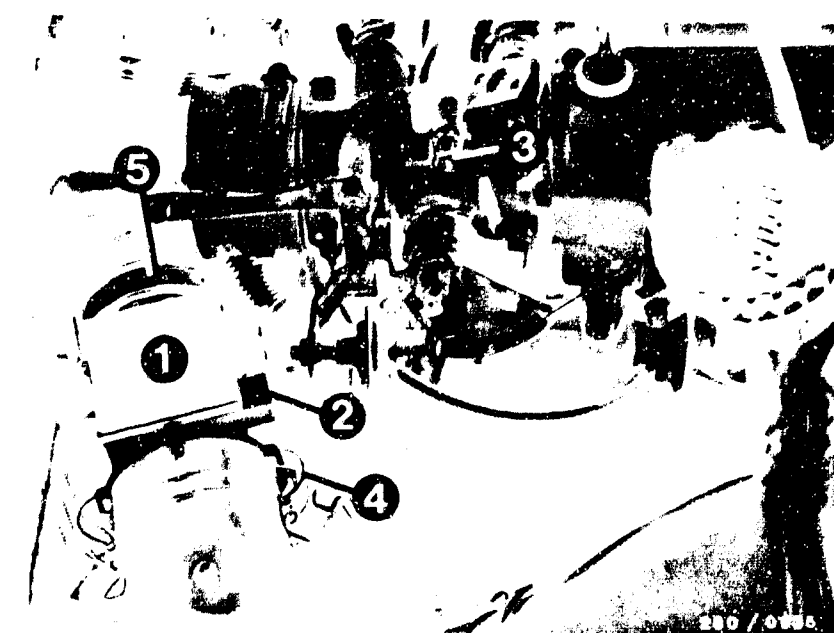
Eliminate contact resistance in the plug connections.

It must not be possible to shove spring contacts back.



Top view of control unit plug

- 1 = Hot-wire air-mass sensor  
2 = Potentiometer



**D5**

Test chart for universal test adapter  
Saab

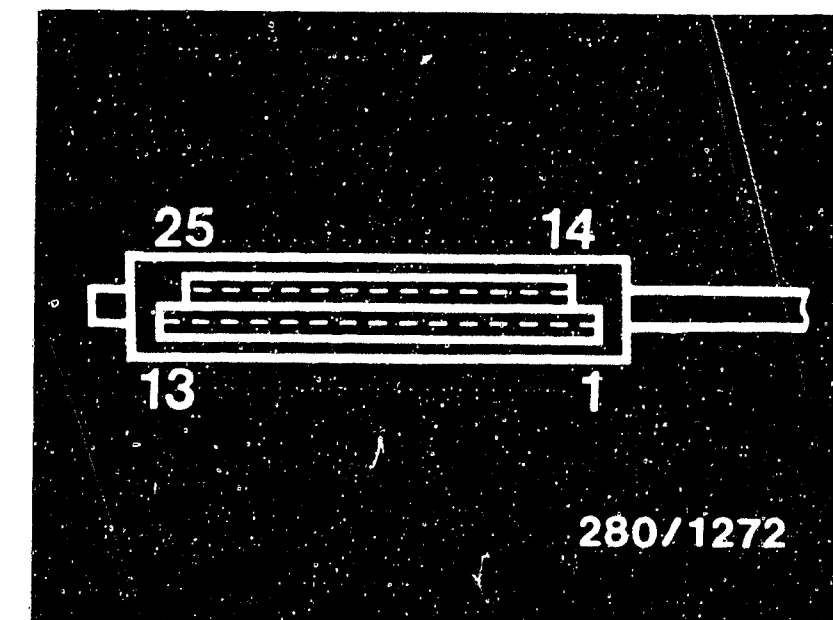


**D6**

Test chart for universal test adapter  
Saab



TEST STEP 8 (Plug in only control unit plug of the adapter lead!)			
N/A as of 8.84			
<u>Operation</u>		<u>Reading</u>	<u>Test on periphery</u>
<u>Program switch "V" in position</u>	4	Reading on test equipment must be <u>8 ... 15 V</u>	<u>Component:</u> Starting motor
<u>Program switch "Ω" in position</u>	21		
<u>Test equipment:</u> Motortester or multimeter		<div>yes</div> <div>no</div>	<u>Function:</u> Starting signal from the starting motor Term. 50 to the control unit Term. 4
<u>Scale:</u> 15 V			
<u>Connection:</u> Test socket/well red = positive Test socket/well black = ground			
<u>Operation in the vehicle:</u> Shift into neutral, start			
		Continue testing with <u>next test step.</u>	<u>Malfunction:</u> No reading for voltage



Top view of control unit plug

### Trouble-shooting:

To test, disconnect the control unit plug from the test adapter and if necessary, use a wiring diagram.

Check the following leads with an ohmmeter for continuity (specified value approx. 0 Ω):

- From the control unit plug Term. 4 to the starting motor Term. 50.

Eliminate contact resistances in the plug connections.

If there is still no reading for voltage, check the starting equipment.

It must not be possible to shove the spring contacts back.

**D7**

Test chart for universal test adapter  
Saab

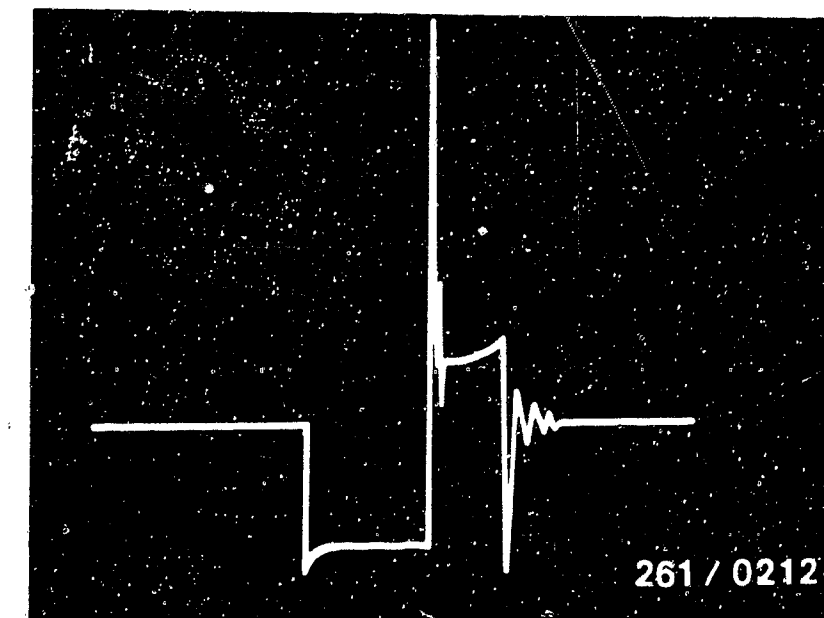


**D8**

Test chart for universal test adapter  
Saab



TEST STEP 9 (Plug in only control unit plug of the adapter lead!)						
Operation			Reading		Test on periphery	
Program switch "V" in position	5		Until 7.85 Primary signal present (see upper illustration). As of 8.85 t <sub>D</sub> signal (see lower illustration)		Component: Ignition coil, ignition leads, control unit	
Program switch "Ω" in position	21					
Test equipment: Motortester with oscilloscope			<div>yes</div> <div>no</div> <div>Continue testing with next test step.</div>		Function: Primary signal from ignition coil terminal 1 or t <sub>D</sub> signal from ignition trigger box terminal 7 to ground	
Scale: Special input, setting % and 10 V (if available)					Malfunction: No signal or incorrect signal	
Connection: Test wells. Red clip to red well, black clip to black well. Trigger clamp on cylinder 1.						
Operation in the vehicle: Ignition "ON". Shift into neutral and start						



Until 7.85  
Term. 1 signal from term. 1 ignition coil (primary signal)

As of 8.85  
t<sub>D</sub> signal from ignition trigger box term. 7 via ignition booster relay

#### Trouble-shooting:

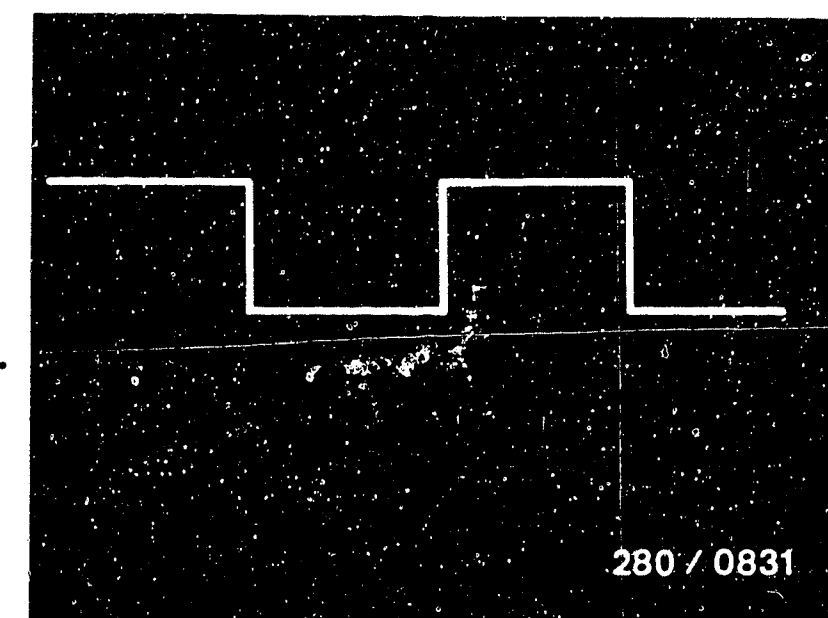
To test, disconnect the control unit plug from the test adapter and if necessary, use a wiring diagram.

Check the following leads with an ohmmeter for continuity (specified value approx. 0 Ω):

Until 7.85

- From the control unit plug Term. 1 to the ignition coil Term. 1. The clamping point on the ignition coil must be bright and the screws must be tightened securely.
- Is there voltage present at Term. 1, ignition coil? If not, check the ignition system.

Continued on D11/D12



**D9**

Test chart for universal test adapter  
Saab



**D10**

Test chart for universal test adapter  
Saab



Continued from D9/D10

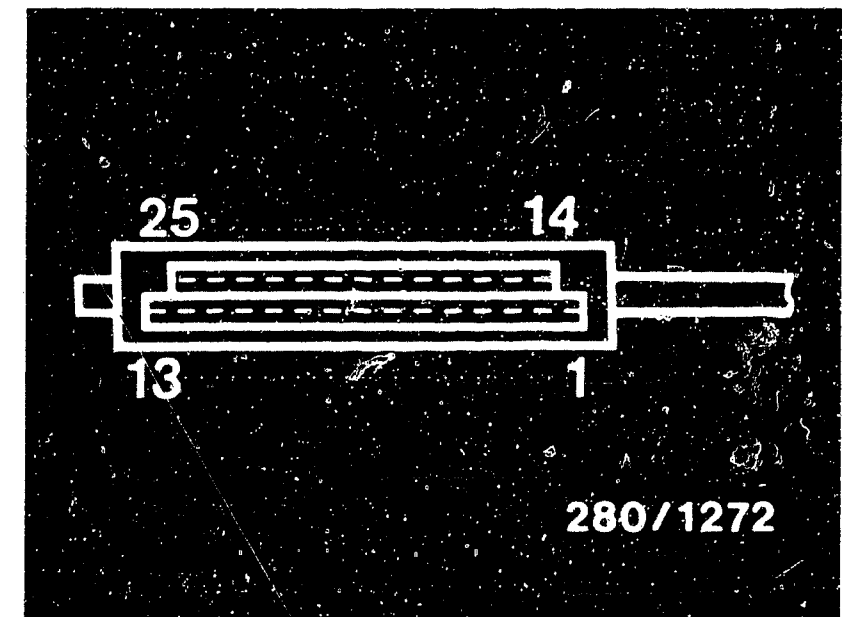
As of 8.85

- From control-unit plug term. 1 via a 29-pin multiple plug term. 24 via an ignition booster relay to ignition trigger box term. 7
- Is there voltage at term. 1 of the ignition coil? If not, inspect ignition system.

Eliminate contact resistances in plug connections. Spring contacts must not be able to be pushed back.

Installation position of components

Ignition coil: in engine compartment diagonally towards the front on radiator panel.



Top view of control-unit plug

**D11**

Test chart for universal test adapter  
Saab



**D12**

Test chart for universal test adapter  
Saab



TEST STEP 10 (Plug in only control unit plug of the adapter lead!)			
Operation		Reading	Test on periphery
Program switch "V" in position	6	Reading on test equipment must be  <u>8 ... 15 V.</u>	Component: Main relay
Program switch "Ω" in position	21		
Test equipment: Motortester or multimeter		<div>yes</div> <div>no</div>	Function: Voltage supply from Term.87, main relay to the control unit plug Term. 9
Scale: 15 V			
Connection: Test socket/well red = positive Test socket/well black = ground			
Operation in the vehicle: Ignition "ON"			
Press button 4.			
		Continue testing with <u>next</u> test step.	Malfunction: No reading for voltage

#### Trouble-shooting:

To test, disconnect the control unit plug from the test adapter and if necessary, use a wiring diagram.

Check the following leads with an ohmmeter for continuity (specified value approx. 0 Ω):

- From the control unit plug Term. 9 to the main relay Term. 87.

- Caution! Disconnect the battery!

From the main relay Term. 30 to the pump relay Term. 30.

- From the pump relay Term. 30 to the battery (positive connection).

- From the main relay Term. 30 to the main relay Term. 86.

- From the main relay Term. 85 to the control unit plug Term. 21.

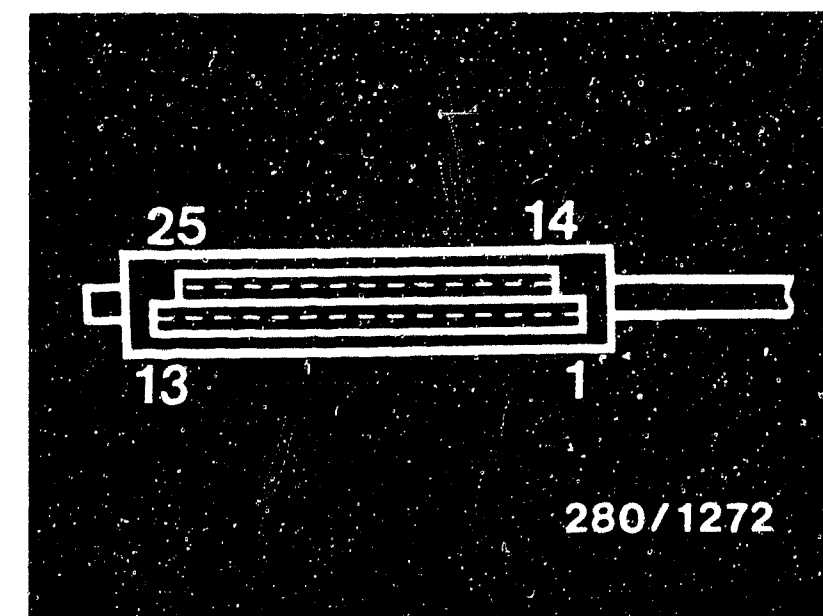
If the leads are O.K. and the test specification is not being attained, take out and replace the main relay. Connect the battery after testing!

Eliminate contact resistances in the plug connections.

It must not be possible to shove spring contacts back.

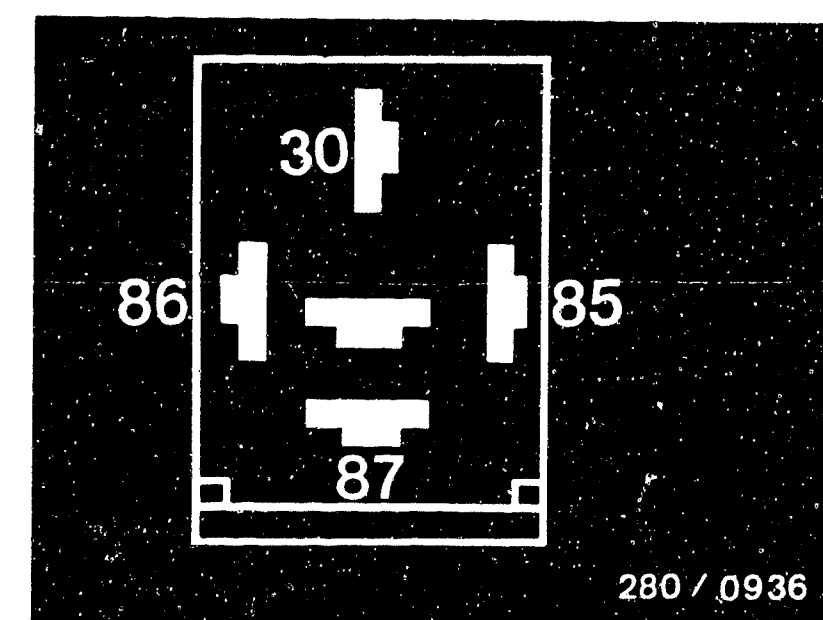
#### Installation position of the components

Main/pump relays: In the passenger compartment, in the front passenger's footwell at the left, next to the LH-control unit.



Top view of control unit plug

Main or pump relay, unplugged.  
Top view of socket



**D13**

Test chart for universal test adapter

Saab



**D14**

Test chart for universal test adapter

Saab





TEST STEP 11 (Plug in only control unit plug of the adapter lead!)			
<u>Operation</u>		<u>Reading</u>	<u>Test on periphery</u>
<u>Program switch "V" in position</u>	7	Reading on test equipment must be <u>8 ... 15 V.</u>	<u>Component:</u> Ignition Lock
<u>Program switch "Ω" in position</u>	21		
<u>Test equipment:</u> Motortester or multimeter		<div>yes</div> <div>no</div>	<u>Function:</u> Voltage supply with Term. 15 for the control unit Term. 18
<u>Scale:</u> 15 V			
<u>Connection:</u> Test socket/well red = positive Test socket/well black = ground			
<u>Operation in the vehicle:</u> Ignition "ON"			
		Continue test- ing with <u>next</u> test step.	<u>Malfunction:</u> No voltage supply

#### Trouble-shooting:

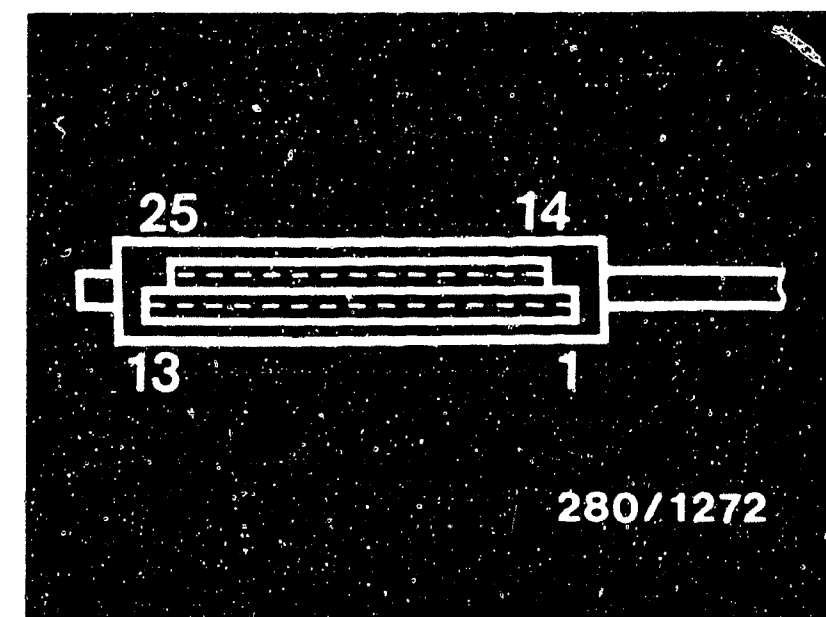
To test, disconnect the control unit plug from the test adapter and if necessary, use a wiring diagram.

Check the following leads with an ohmmeter for continuity (specified value approx. 0 Ω):

- From the control unit plug Term. 18 to the ignition lock Term. 15.

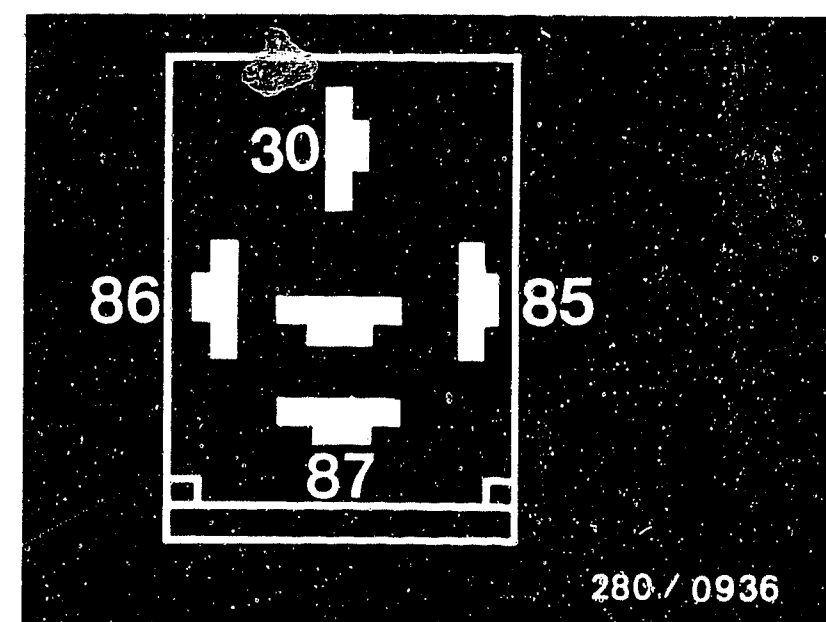
Eliminate contact resistances in the plug connections.

It must not be possible to shove spring contacts back.



Top view of control unit plug

Main and pump relays unplugged.  
Top view of socket.



**D 15**

Test chart for universal test adapter  
Saab



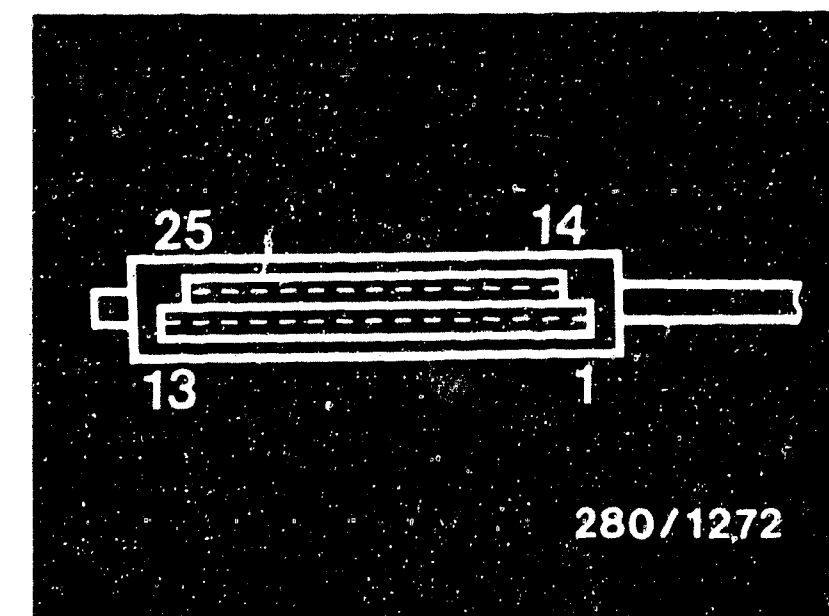
**D 16**

Test chart for universal test adapter  
Saab





TEST STEP 12 (Plug in only control unit plug of the adapter lead!)					
Operation		Reading		Test on periphery	
<u>Program switch "V" in position</u>		8	Reading on the test equipment must be  <u>8 ... 15 V.</u>		Component: <u>Main relay</u>
<u>Program switch "Ω" in position</u>		21			
<u>Test equipment:</u> Motortester or multimeter			<div>yes</div> <div>no</div>	Function: <u>Main relay</u> coil and ground connection to the control unit Term. 21	
<u>Scale:</u> 15 V					
<u>Connection:</u> Test socket/well red = positive Test socket/well black = ground					
<u>Operation in the vehicle:</u> Ignition "ON"		Continue test- ing with <u>next</u> <u>test step.</u>		Malfunction: <u>No reading for voltage</u>	



Top view of control unit plug

#### Trouble-shooting:

To test, disconnect the control unit plug from the test adapter and if necessary, use a wiring diagram.

Check the following leads with an ohmmeter for continuity (specified value approx. 0 Ω):

- From the control unit plug Term. 21 to the main relay Term. 85.

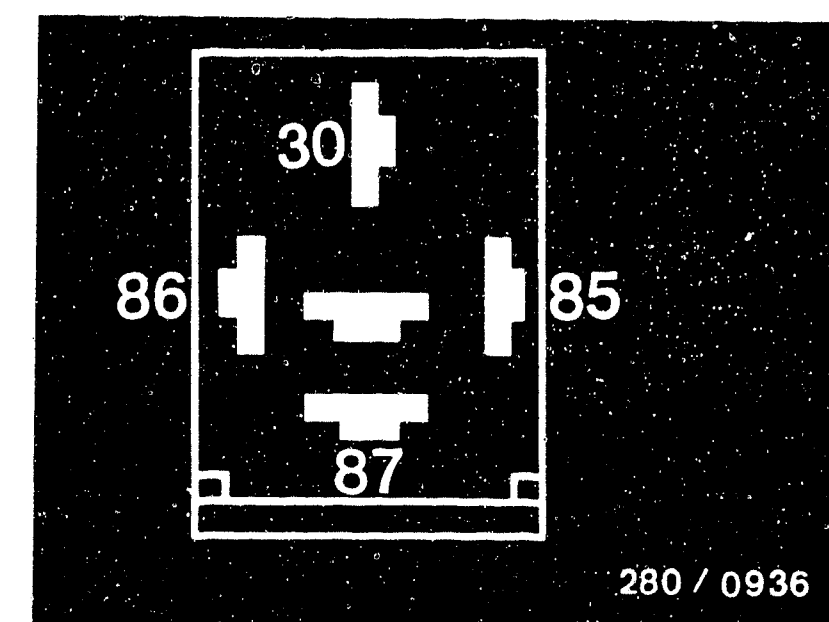
Eliminate contact resistances in the plug connections.

It must not be possible to shove spring contacts back.

#### Installation position of the components:

Main relay: In the passenger compartment, in the front passenger's footwell on the right next to the LH-control unit.

Main and pump relays unplugged.  
Top view of socket.



**D 17**

Test chart for universal test adapter  
Saab

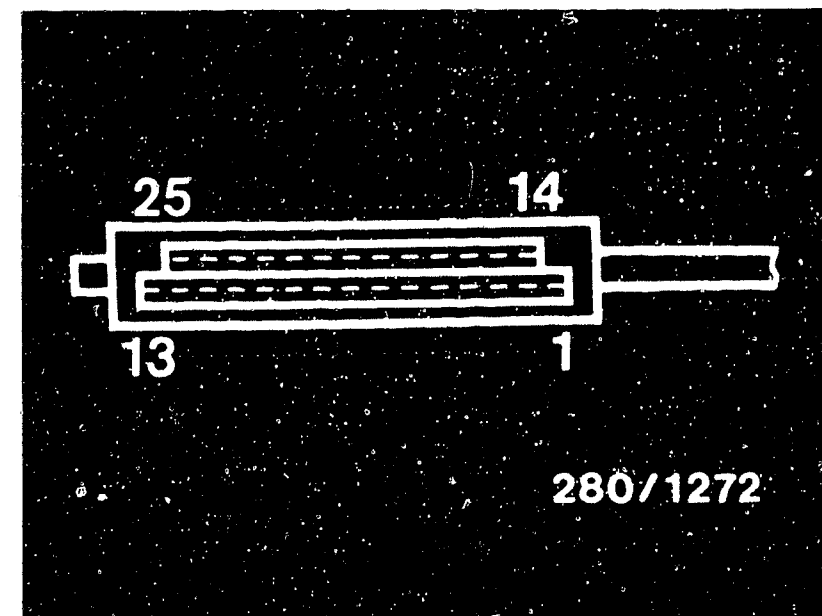


**D 18**

Test chart for universal test adapter  
Saab



TEST STEP 13 (Plug in only control unit plug of the adapter lead!)			
Operation		Reading	Test on periphery
Program switch "V" in position	9	Reading on test equipment must be  8 ... 15 V.	Component: Pump relay Pressure-sensing switch
Program switch "Ω" in position	21		
Test equipment: Motortester or multimeter		<div>yes</div> <div>no</div>	Function: Pump relay-coil and ground connection to the control unit Term. 17  Malfunction: No reading for voltage
Scale: 15 V			
Connection: Test socket/well red = positive Test socket/well black = ground			
Operation in the vehicle: Ignition "ON". Press button 4.			
		Continue testing with next test step.	



Top view of control unit plug

Trouble-shooting:  
To test, disconnect the control unit plug from the test adapter and if necessary, use a wiring diagram.

Check the following leads with an ohmmeter for continuity (specified value approx. 0 Ω):

- From the control unit plug Term. 17 to the pump relay Term. 85
- From the pump relay Term. 86 via the pressure-sensing switch to the main relay Term. 87.

If there is a defect, take measurements directly on the pressure-sensing switch.

At atmospheric pressure, charge-air pressure: 0 Ω.

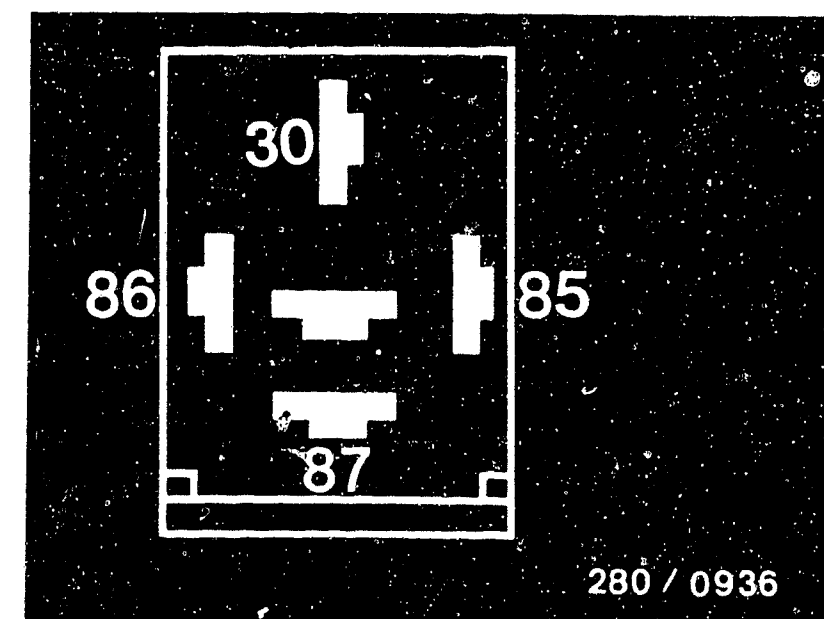
Starting from 1.05 bar charge-air pressure, the pressure sensing switch must switch over: ∞ Ω.

Eliminate contact resistances in the plug connections.  
It must not be possible to shove spring contacts back.

Installation position of the components:

Pump relay: In the passenger compartment, in the front passenger's footwell on the right, next to the LH-control unit.

Main and pump relays unplugged.  
Top view of socket



TEST STEP 14 (Connect adapter lead to control unit and periphery!)			
Operation		Reading	Test on periphery
Program switch "V" in position	3	Reading on test equipment must be <u>2 ... 5 V.</u>	Component: Hot-wire air-mass sensor
Program switch "Q" in position	21		
Test equipment: Motortester or multimeter		<div>yes</div> <div>↓</div> <div>Continue test- ing with <u>next</u> test step.</div>	<div>Function:</div> <div>Output voltage between Term. 7 and Term. 6 on the control unit plug</div>
Scale: 10 V			
Connection: Test socket/well red = positive Test socket/well black = ground			
Operation in the vehicle: Run the engine. When engine speed changes, the output voltage must also change.			
		<div>no</div> <div>↓</div>	<div>Malfunction:</div> <div>No reading for voltage No change in voltage</div>

#### Trouble-shooting:

To test, disconnect the control unit plug from the test adapter and if necessary, use a wiring diagram.

Check the following leads with an ohmmeter for continuity (specified value approx. 0 Ω):

- From the control unit plug Term. 7 to the air-mass sensor Term. 5.
- From the air-mass sensor Term. 4 to the sensor ground terminal.
- From the air-mass sensor Term. 2 to the main relay Term. 87b.

Note: When the engine speed changes, the output voltage must also change.

Eliminate contact resistances in the plug connections.

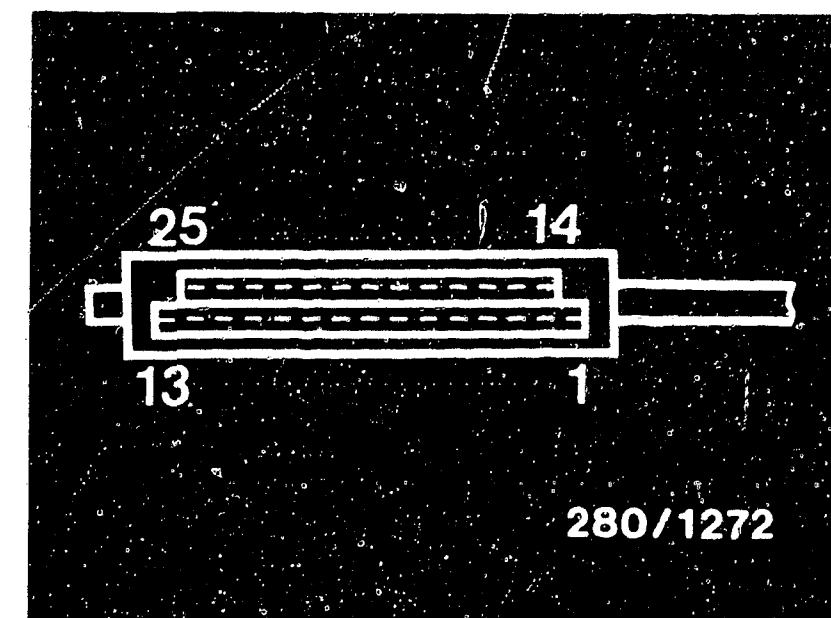
It must not be possible to shove spring contacts back.

#### Installation position of the components

Air-mass sensor: Between the air filter and the intake manifold on the left in the engine compartment.

Ground terminal: Under the front fastening screw for the fuel distribution pipe, in the center of the engine compartment.

Main relay: In the passenger compartment, in the front passenger's footwell, on the left next to the LH-control unit.



Top view of control unit plug



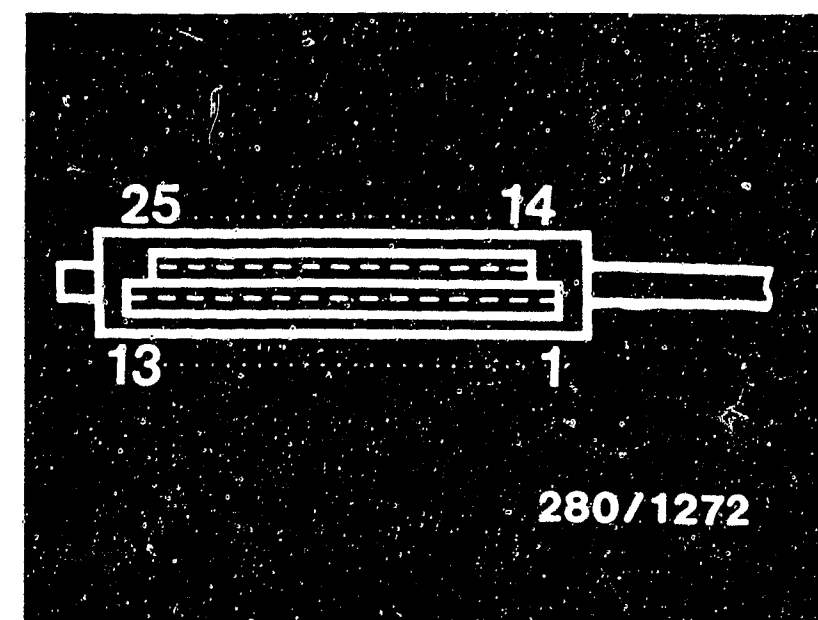
TEST STEP 15 (Connect adapter lead to control unit and periphery!)			
Operation		Reading	Testing of control unit
Program switch "V" in position	12	The test equipment must show an injection signal. (See Figure at bottom.)	Component: Control unit
Program switch "Ω" in position	21		
Test equipment: Ignition oscilloscope		<div>yes</div> <div>no</div> <div>Continue testing with next test step.</div>	Function: Output stage
Scale: ms or 20 V - special input			
Connection: Test socket/well red = positive Test socket/well black = ground			Malfunction: No injection signal or incorrect signal
Operation in the vehicle: Have engine run at normal operating temperature			

#### Trouble-shooting:

To test, disconnect the control unit plug from the test adapter and if necessary, use a wiring diagram.

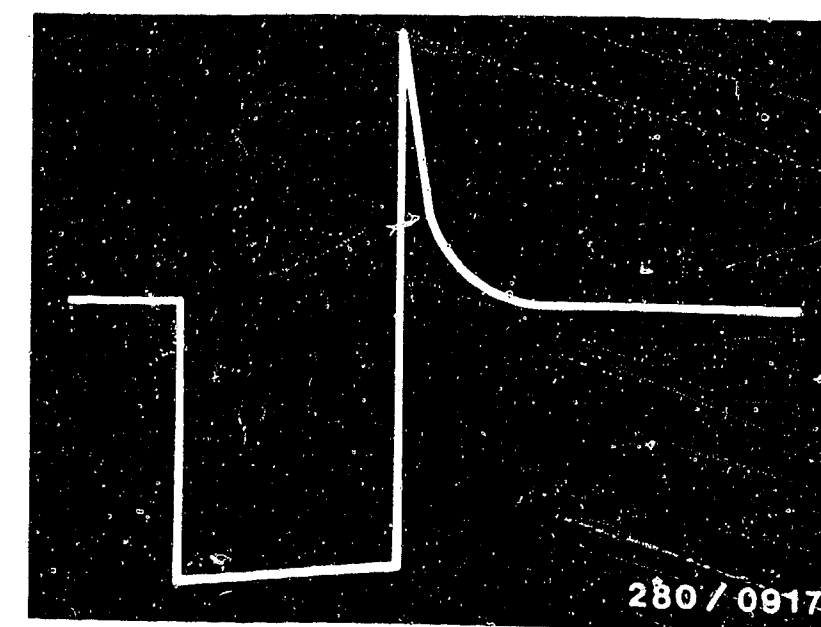
If there is no fuel-injection signal visible on the oscilloscope, change the triggering. (Put the clamp-on pickup on a different cylinder.)

If there is no fuel-injection signal, or an incorrect signal, take out and replace the control unit.



Top view of control unit plug

Injection signal



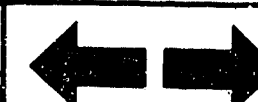
**D23**

Test chart for universal test adapter  
Saab



**D24**

Test chart for universal test adapter  
Saab



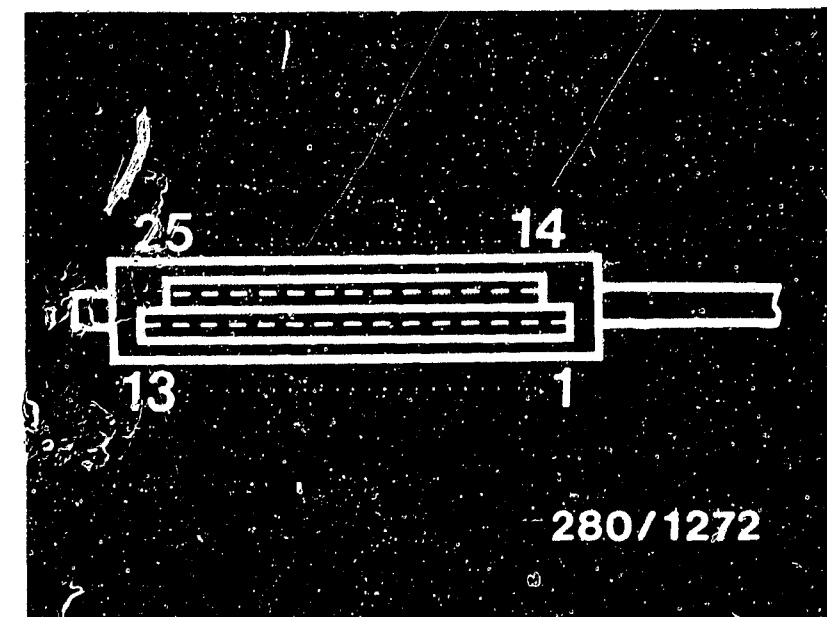
TEST STEP 16 (Connect adapter lead to control unit and periphery!)			
Operation		Reading	Testing of control unit
Program switch "V" in position	12	Tester must show injection signal. After pressing key T1 (NTC II - cold) the injection signal <u>must</u> become <u>wider</u> (see lower illustration) and/or engine speed increases. <u>Press key only briefly!</u> (Engine enriches severely)	Component: Control unit
Program switch "Q" in position	21		
Test equipment: Ignition oscilloscope			
Scale: ms, 20 V - special input			Function: Warm-up Temperature effect, cold (engine)
Connection: Test socket/well red = positive Test socket/well black = ground		<div>yes</div> <div>no</div>	
Operation in the vehicle: Have engine run at normal operating temperature.		Continue testing with <u>next test step</u> .	Malfunction: The fuel-injection signal does not become wider when button T1 is pressed.
Press button 1.			

#### Trouble-shooting:

To test, disconnect the control unit plug from the test adapter and if necessary, use a wiring diagram.

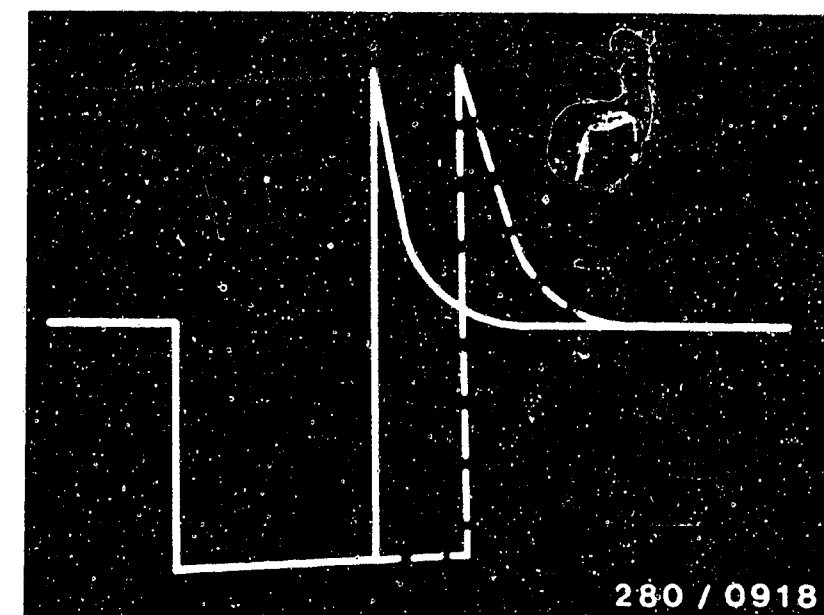
If injection pulse does not become wider → connect exhaust-gas tester.  
CO value must increase when key 1 is pressed (more than 5 % vol. CO)

If CO value does not rise → replace control unit.



Top view of control unit plug

Widened fuel-injection signal after button T1 is pressed



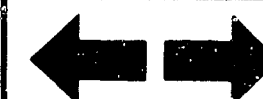
E1

Test chart for universal test adapter  
Saab

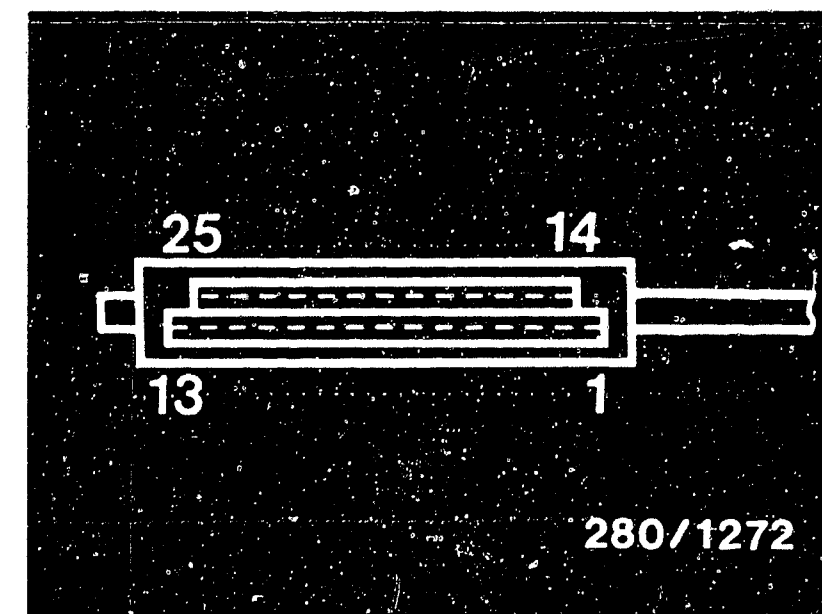


E2

Test chart for universal test adapter  
Saab



TEST STEP 17 (Connect adapter lead to control unit and periphery!)			
Operation		Reading	Testing of control unit
<u>Program switch "V" in position</u>	12	Test equipment must show an injection signal.  When button T2 is pressed, it is not permissible for the fuel-injection signal to become wider. (See Figure at bottom.)	Component: Control unit
<u>Program switch "Ω" in position</u>	21		
<u>Test equipment:</u> Ignition oscilloscope			
<u>Scale:</u> ms, 20 V - special input		<div><div>yes</div><div>↓</div></div>	<u>Function:</u> Warm-up, cut back Temperature effect, warm (engine)
<u>Connection:</u> Test socket/well red = positive Test socket/well black = ground			
<u>Operation in the vehicle:</u> Have engine run at normal operating temperature.			
Press button 2.		Continue testing with <u>next test step.</u>	<u>Malfunction:</u> The fuel-injection signal becomes wider after button T2 is pressed.



Top view of control unit plug

#### Trouble-shooting:

To test, disconnect the control unit plug from the test adapter and if necessary, use a wiring diagram.

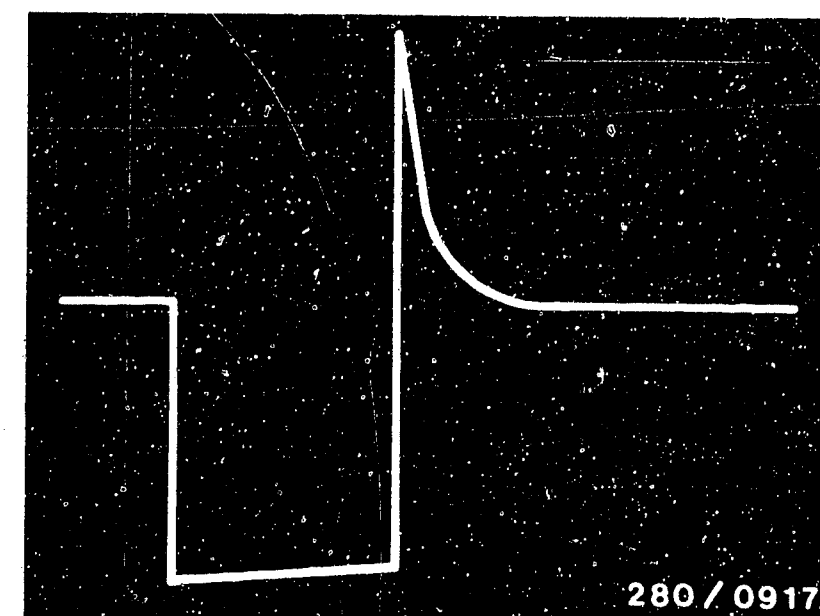
It is not permissible for the fuel-injection signal to become wider.  
CO value must remain the same.

If the injection signal does become wider, the engine is not at normal operating temperature.

Run the engine for approx. 5 min. at 3000 min<sup>-1</sup>.

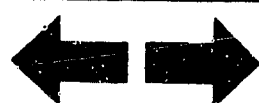
Repeat the test.

If the problem is not corrected, take out and replace the control unit.



**E3**

Test chart for universal test adapter  
Saab



**E4**

Test chart for universal test adapter  
Saab



TEST STEP 18 (Connect adapter lead to control unit and periphery!)		
Operation		Reading
Program switch "V" in position	12	Tester must show injection pulse. After pressing key T6 (full-load enrichment) the injection signal <u>must</u> become <u>slightly wider</u> and/or the engine speed must increase slightly (see lower illustration).
Program switch "Ω" in position	21	
Test equipment: Ignition oscilloscope		
Scale: ms, 20 V - special input		<div> <div>yes</div> <div>no</div> </div>
Connection: Test socket/well red = positive Test socket/well black = ground		
Operation in the vehicle: Run engine at normal operating temperature.		
Press button 6.		Continue testing with <u>next test step</u> .
		<div>Function:</div> <div>Full-load enrichment</div>
		<div>Malfunction:</div> <div>Injection signal does not become wider.</div>

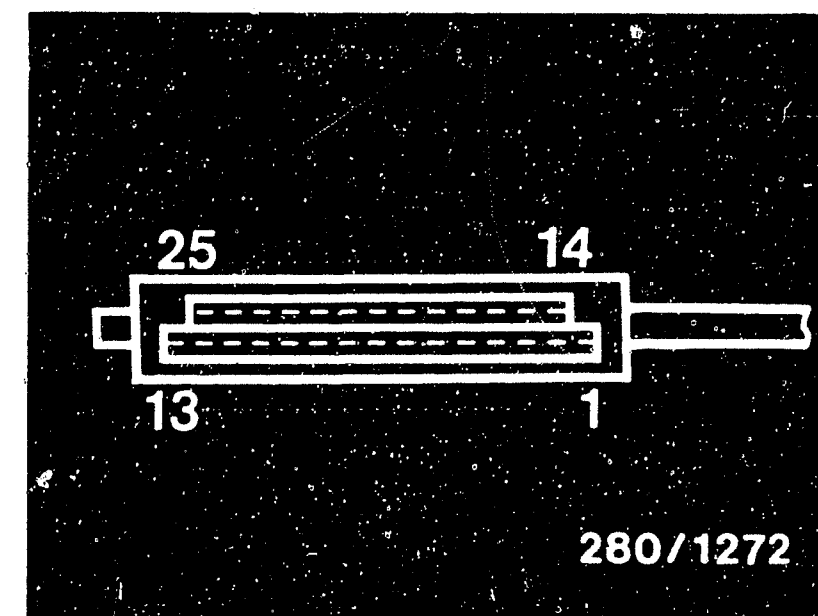
#### Trouble-shooting:

To test, disconnect the control unit plug from the test adapter and if necessary, use a wiring diagram.

If the injection pulse does not become wider, the engine speed must increase.

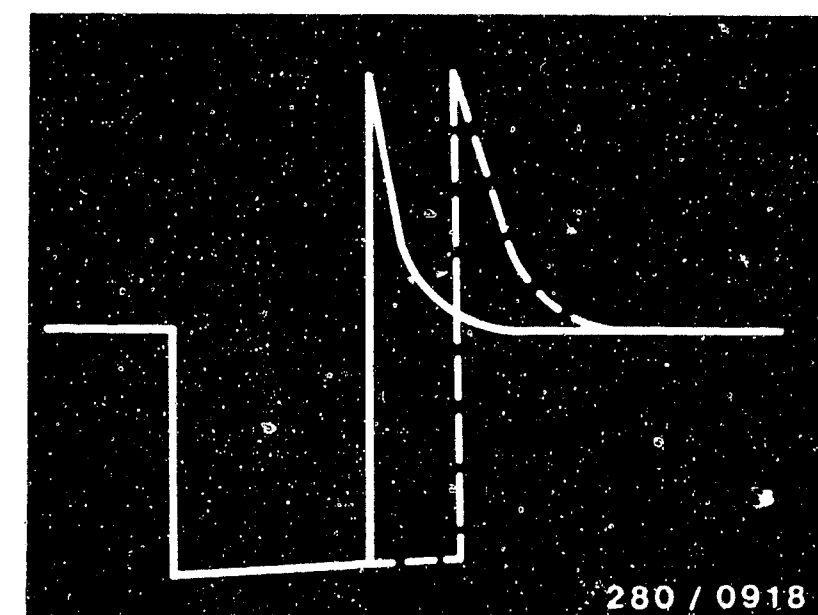
If injection the injection signal does not become wider or the engine speed does not increase → connect exhaust-gas tester.

CO value must increase when key 6 is pressed (more than 1 % vol. CO)



Top view of control unit plug

Widened fuel-injection signal after pressing button T6



**E5**

Test chart for universal test adapter  
Saab



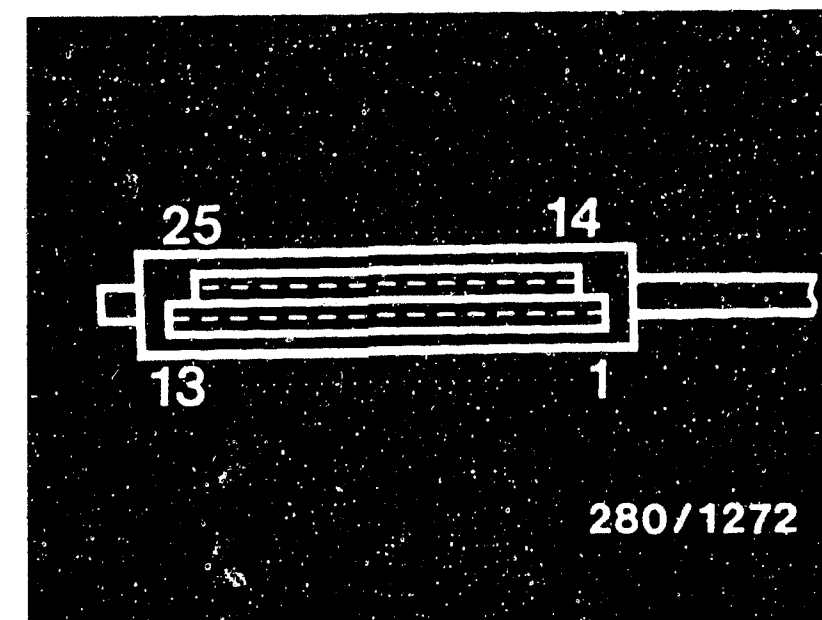
**E6**

Test chart for universal test adapter  
Saab





TEST STEP 19 (Connect adapter lead to control unit and periphery)			
Operation		Reading	Test on control unit
Program switch "V" in position	13	The reading for voltage after approx. 4 secs on the test equipment must be from  2 ... 5 V (duration of reading approx. 1 sec).	Component: Control unit
Program switch "Ω" in position	21		Function: Self-cleaning Voltage pulse at control unit plug Term. 8 to Term. 11
Test equipment: Motortester or multimeter			
Scale:	10 V		
Connection: Test socket/well red = positive Test socket/well black = ground		yes ↓	
Operation in the vehicle: Run engine at normal operating temperature at min. 2000 min <sup>-1</sup> . After that, ignition "OFF".		no ↓	Malfunction: Continuous pulse or no pulse
		Continue testing with next test step.	



Top view of control unit plug

#### Trouble-shooting:

To test, disconnect the control unit plug from the test adapter and if necessary, use a wiring diagram.

If the self-cleaning pulse is not as shown above, take out the hot-wire air-mass sensor, and leave the plug plugged in. Repeat test step 19, observing the hot-wire while so doing. After approx. 4 secs, the hot-wire must glow for approx. 1 sec.

If the hot-wire glows: check the connections and/or the setting on the measuring equipment.

If the hot-wire does not glow:

- Is engine temperature less than 60°C? Warm the engine up.
- The hot-wire in the hot-wire air-mass sensor is broken. Take out and replace the hot-wire air-mass sensor.
- The control unit is defective. Take it out and replace it.

E7

Test chart for the universal test adapter  
Saab



E8

Test chart for the universal test adapter  
Saab





Testing with the universal test adapter has been completed.

The fuel pressure test must now be run.

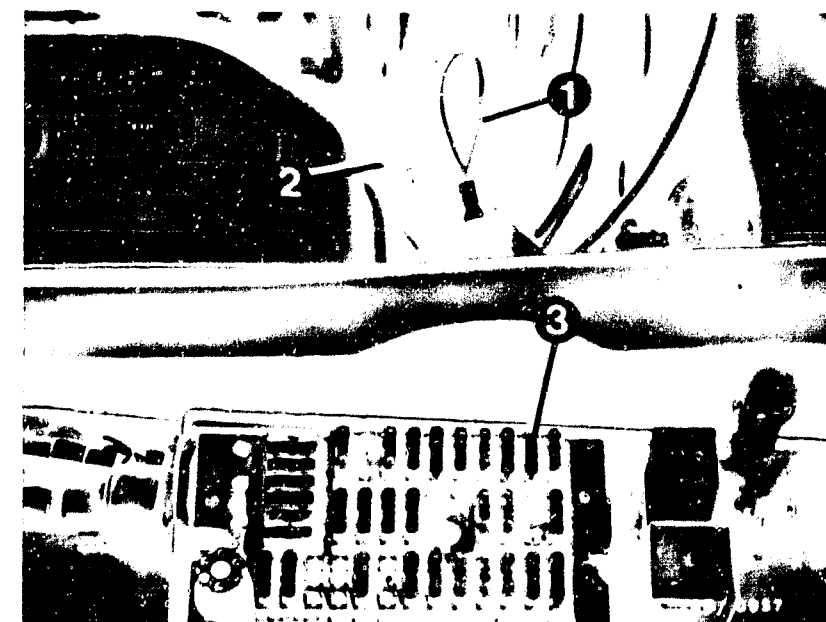
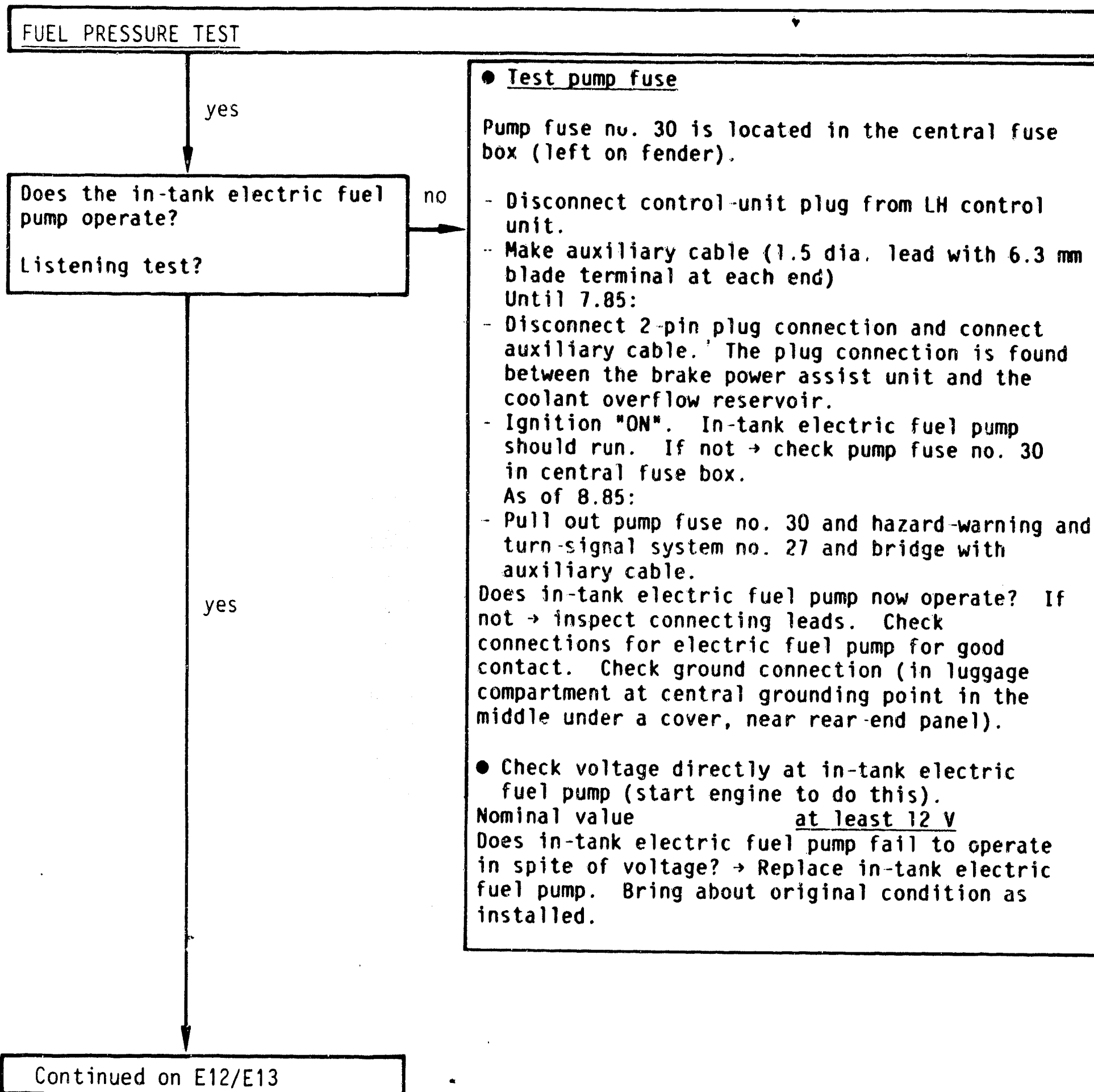
If a defect has been found in one of the tests, that test must be repeated after correction of the defect.

The fuel pressure test is described at Coordinates E10...F11.

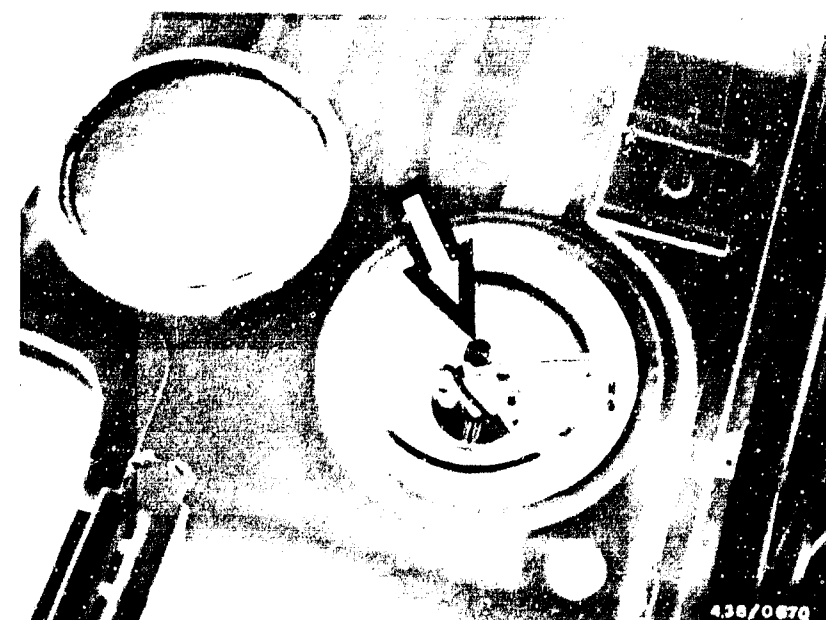
**E9**

Test chart for universal test adapter  
Saab





1 = Auxiliary cable  
2 = 2-pin plug connection  
3 = Pump fuse



**E10**

Fuel pressure test  
Saab



**E11**

Fuel pressure test  
Saab



## Fuel pressure test (continued)

Is the in-tank electric fuel pump OK?

Removal and installation

no

yes

### In-tank electric fuel pump Removal and installation

#### ● Removal

- Disconnect the ground lead of the battery.
- Lift out the floor plate and the cover in the trunk compartment. Release the round cover above the in-tank electric fuel pump.
- Remove the cable connections on the in-tank electric fuel pump.
- Unscrew the cap nut. When so doing, hold the electric fuel pump with an open-end wrench, AF 17. Take off the inlet union of the fuel line. (Figure at center).

#### Caution!

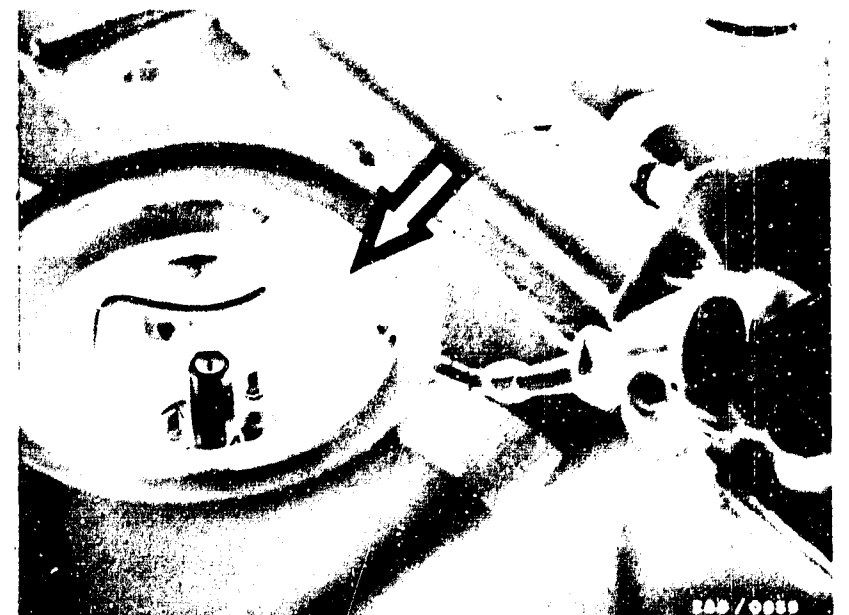
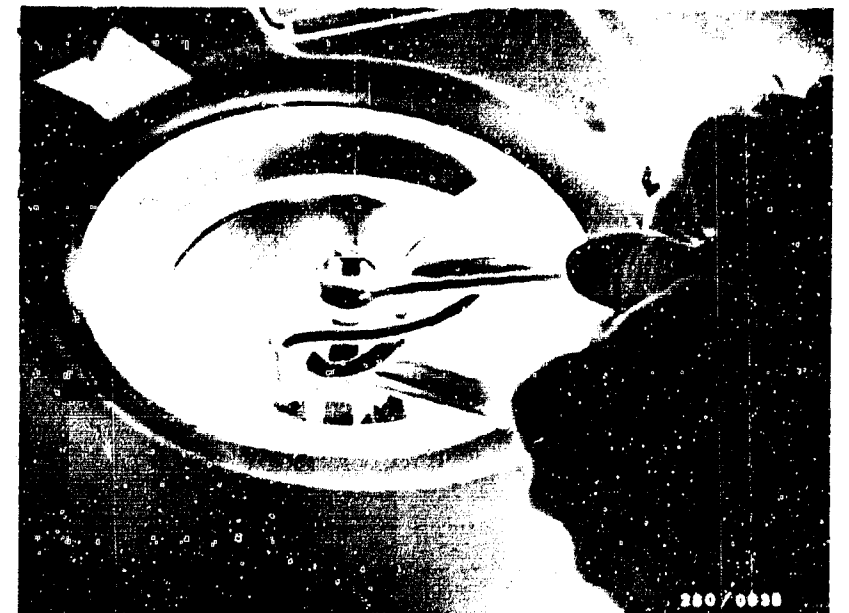
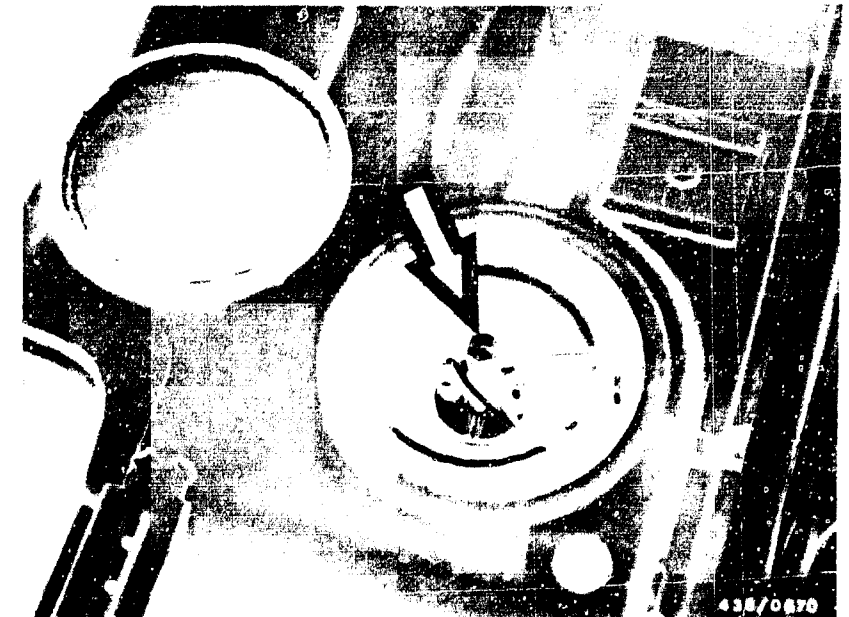
When unscrewing the fuel delivery line, make certain that no fuel can escape. Take suitable actions. (Carefully pinch off the fuel delivery line.)

#### Fire hazard!

- Release the brackets of the in-tank electric fuel pump holder using a flexible screwdriver (through the assembly opening). (See figure at bottom.)

Continued on E18/E19

Continued on E14/E15



**E12**

Fuel pressure test  
Saab



**E13**

Fuel pressure test  
Saab



# Fuel pressure test (continued)

yes

yes

- Lift the in-tank electric fuel pump out.
- Release the cable clamps for the intake filter and the clamps for the rubber mounting (figure at center - arrows) and take both parts off the electric fuel pump.
- Shove the intake filter all the way on the intake fitting of the new electric fuel pump, and temporarily tighten the clamping band lightly.

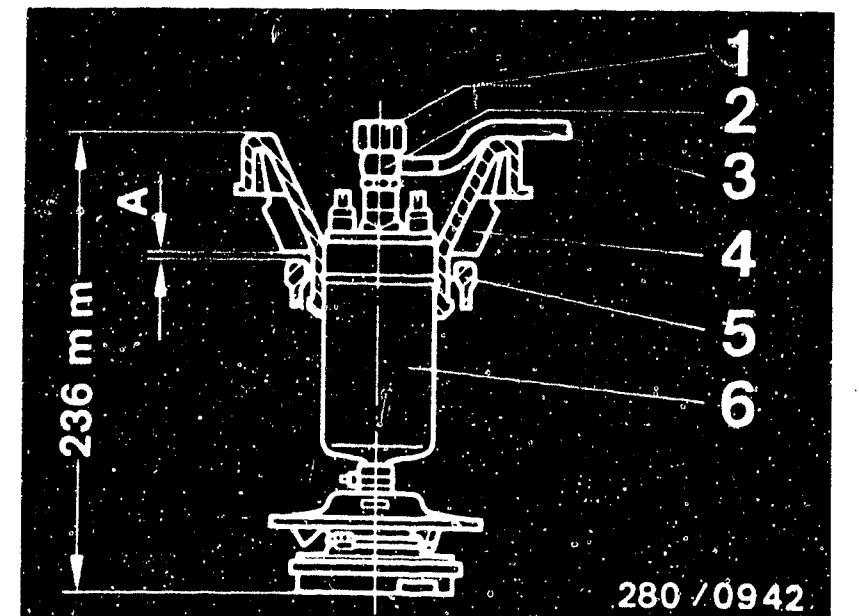
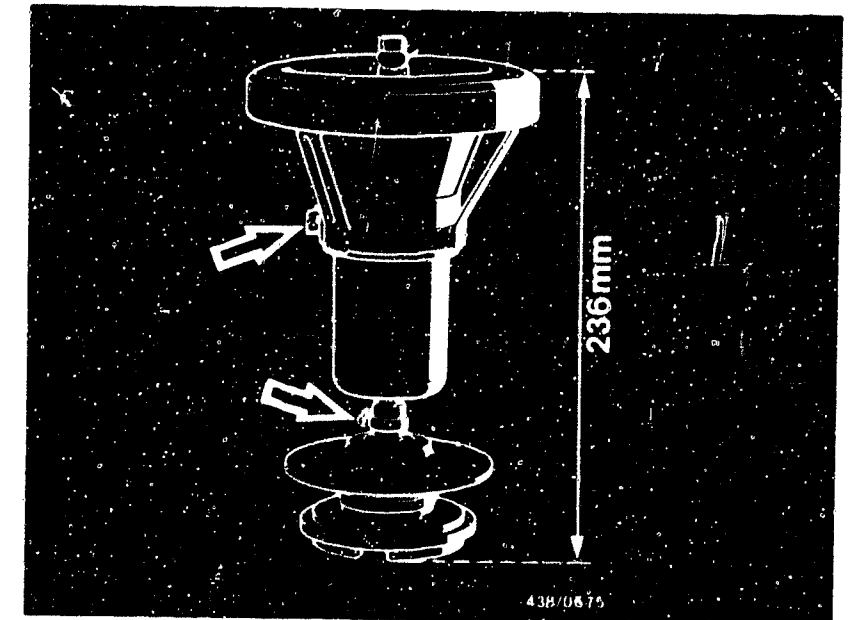
## ● Installation

Assemble the in-tank electric fuel pump to the mounting base in such a way that the vertical dimension between the lower edge of the intake filter and the upper edge of the rubber mounting is 236 mm. Attach the pump support and the brackets in such a way that dimension A = 2...6 mm.

- 1 = Cap nut
- 2 = Non-return valve
- 3 = Fuel line
- 4 = Pump support
- 5 = Bracket
- 6 = Electric fuel pump

Continued on E18/E19

Continued on E16/E17



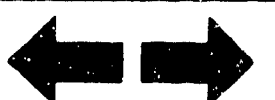
**E14**

Fuel pressure test  
Saab



**E15**

Fuel pressure test  
Saab



# Fuel pressure test (continued)

yes

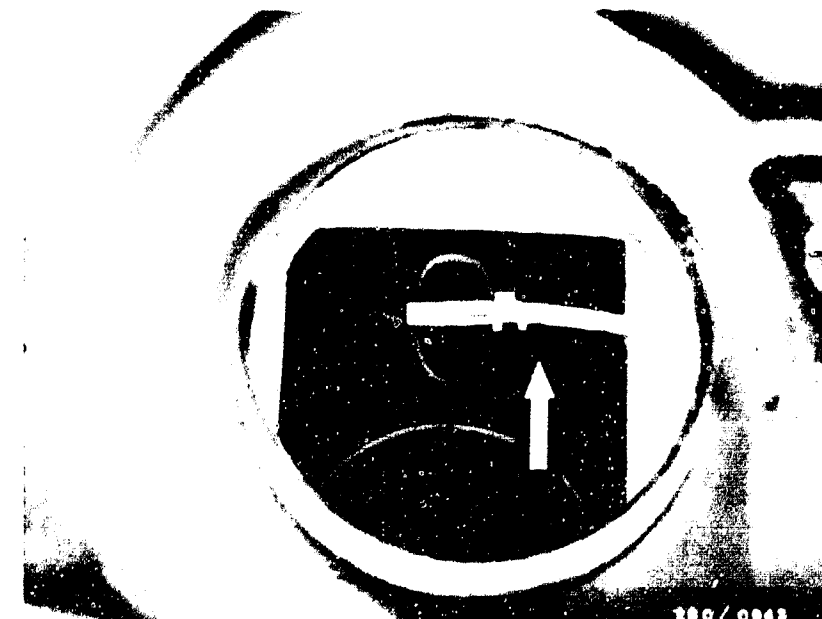
- Check whether the fuel return line is attached to the splash tank at the base of the fuel tank (figure at top - arrow).
- Put the entire in-tank electric fuel pump into the fuel tank as follows:
  - Locate the positive lead terminal toward the left looking in the direction of forward vehicle travel.
  - Set up the intake filter inlet at an angle of 45° to the rear/right, looking in the direction of forward vehicle travel.

The rest of the installation takes place in reverse order.

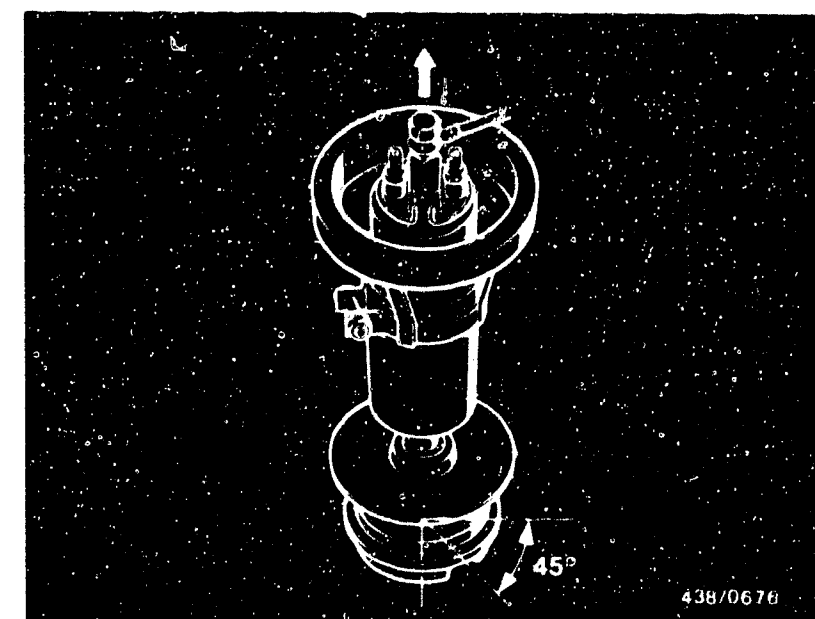
After testing and repair, the original condition of installation must be restored.

yes

Continued on E18/E19



Arrow = Direction of forward vehicle travel



**E16**

Fuel pressure test  
Saab



**E17**

Fuel pressure test  
Saab



# Fuel pressure test (continued)

yes

Is the fuel pressure OK?

Pressure regulator:  
0 280 160 214, ..255

• Test specification:  
2.3 ... 2.7 bar

Pressure regulator:  
0 280 160 264

• Test specification:  
2.6 ... 3.0 bar

Is the test specification being met?

no

## Checking fuel pressure

- Connect the pressure gauge (1) and/or the pressure tester. Unscrew the fuel delivery hose from the pressure regulator (3).

### Caution!

When unscrewing the hose, make certain that no fuel gets on hot portions of the engine.

- Put in connection at KDJE-P 100/14 (2).
- When using the pressure tester KDJE-P 100, the valve screw must be turned shut, with KDEP 1034 only the screw on the right.

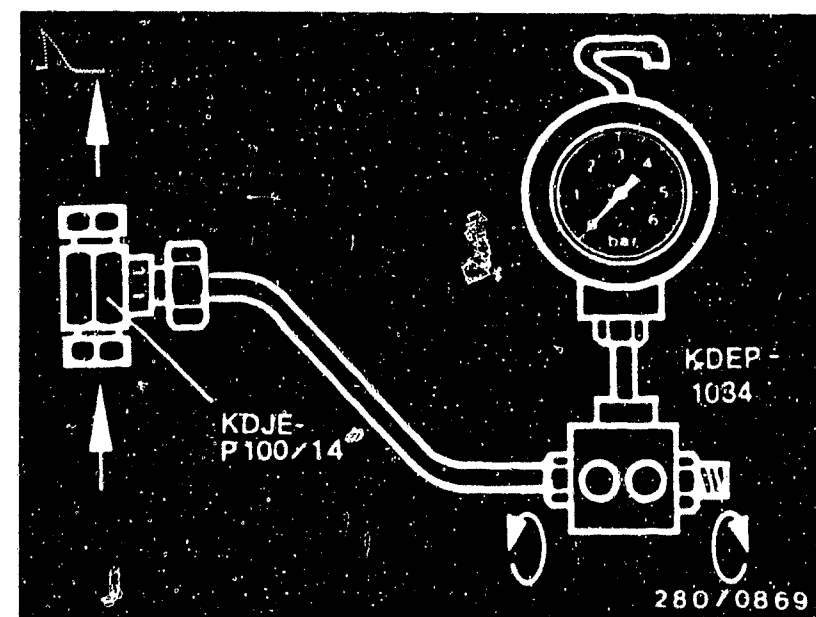
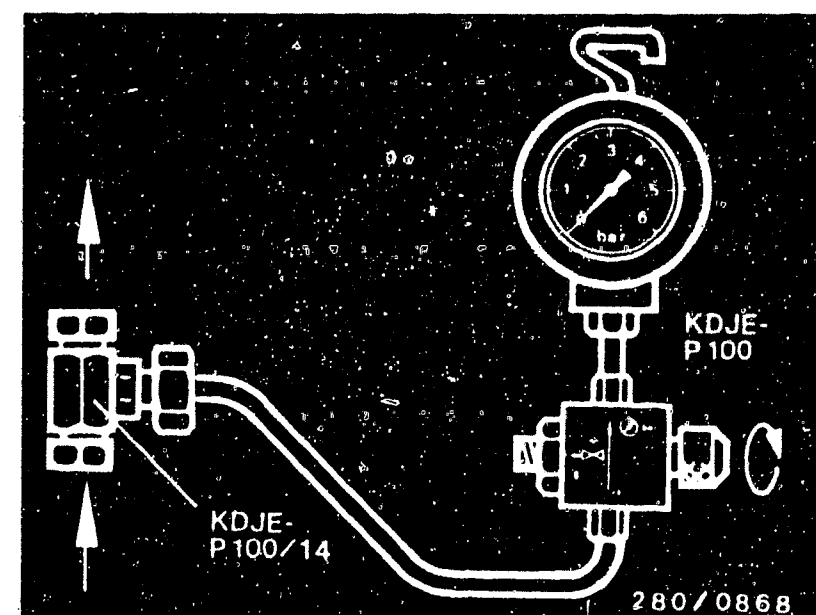
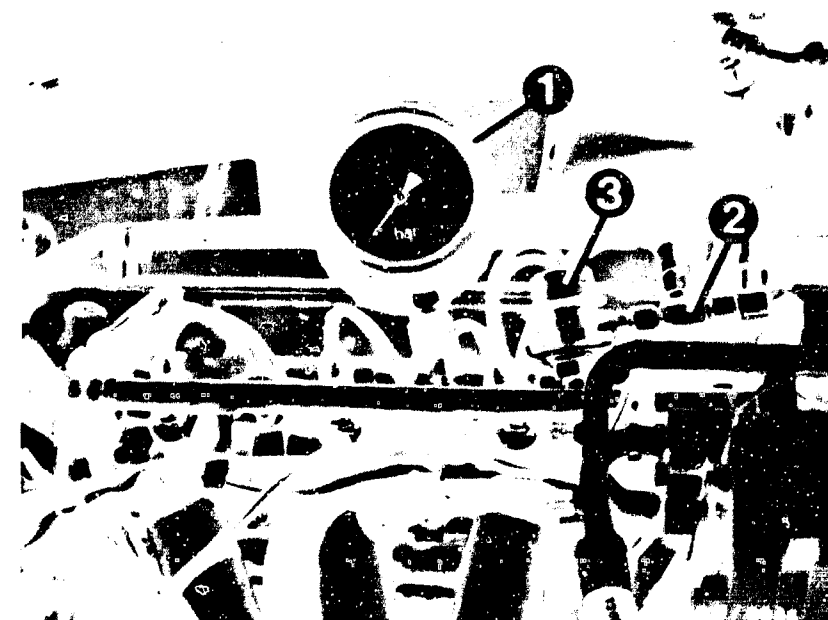
Make certain connections do not leak.

yes

yes

Continued on E20/E21

Continued on E20/E21



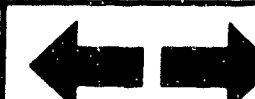
E18

Fuel pressure test  
Saab



E19

Fuel pressure test  
Saab



# Fuel pressure test (continued)

yes

Is the fuel pressure OK?  
Is the pressure regulator OK?

0 280 160 214, ..255

Test specification:  
2.3 ... 2.7 bar

0 280 160 264

Test specification:  
2.6 ... 3.0 bar

Is the test specification being met?

yes

Continued on F7/F8

- Jumping the safety circuit
  - Disconnect the control unit plug from the LH-control unit.
  - Make an auxiliary lead (lead  $\varnothing$  1.5 mm and blade terminals 6.3 mm at both ends)
- Until 7.85
- Take apart the 2-pin plug connection and plug on the auxiliary leads.
- As of 8.85:
- Pull out fuses no. 30 and no. 27, and connect base with auxiliary cable.
- Ignition "ON". Read fuel pressure on the pressure gauge.

- Test specification for fuel pressure
 

0 280 160 214, ..255	<u>2.3 ... 2.7 bar</u>
0 280 160 264	<u>2.6 ... 3.0 bar</u>
- Switch ignition off. Remove auxiliary lead, and restore the proper plug connection.
- Start the engine and run it.  
The fuel pressure goes back to approx. 2.0 bar (depending on the intake manifold pressure).

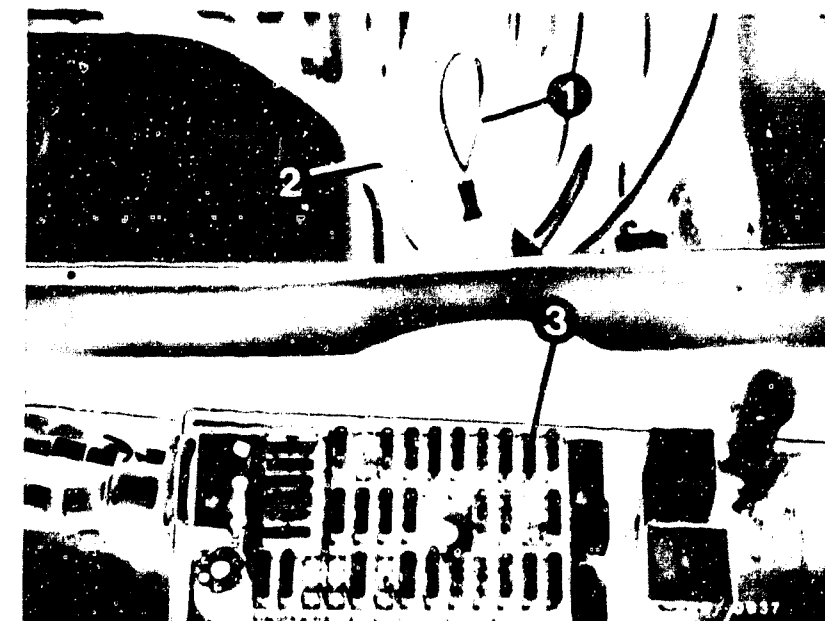
If not, check the pressure regulator.

no

- Check the pressure regulator.  
Start the engine and run it.  
Test specification for fuel pressure: approx. 2.0 bar
- Pull intake-mainfold hose from pressure regulator.
- Test specification for fuel pressure
 

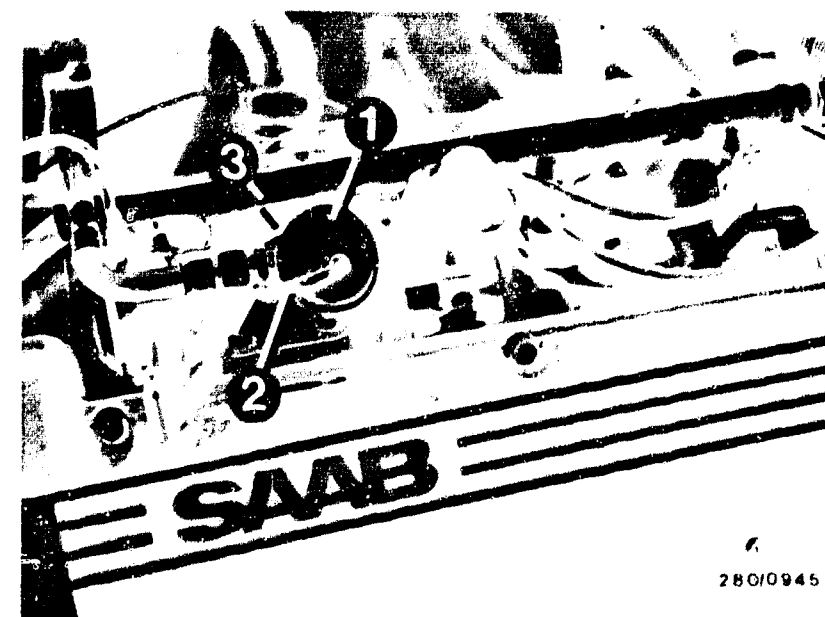
0 280 160 214, ..255	<u>2.3 ... 2.7 bar</u>
0 280 160 264	<u>2.6 ... 3.0 bar</u>

Continued on E22/E23



1 = Auxiliary lead  
2 = 2-pin plug connection  
3 = Pump fuse

1 = Pressure regulator  
2 = Intake manifold connection (vacuum hose)



E20

Fuel pressure test  
Saab



E21

Fuel pressure test  
Saab



280/0945

## Fuel pressure test (continued)

Fuel pressure of 2.3 bar (with pressure regulator 0 280 160 214, ..255) or 2.6 bar (with pressure regulator 0 280 160 264) is not reached:

- Slowly pinch off the fuel return line.  
Caution!  
Do not load the pressure gauge beyond 6 bar!  
If the pressure rises above 4 bar, take out and replace the pressure regulator. The pressure regulator is fastened to the fuel distribution pipe by means of a hose.
- The fuel delivery line, fuel filter are clogged. Make certain they are installed in the correct direction.
- The filter in the tank is clogged.
- Corrosion in the tank.
- The in-tank electric fuel pump is defective.

Upper illustration: 1 = Pressure regulator  
3 = Fuel return line

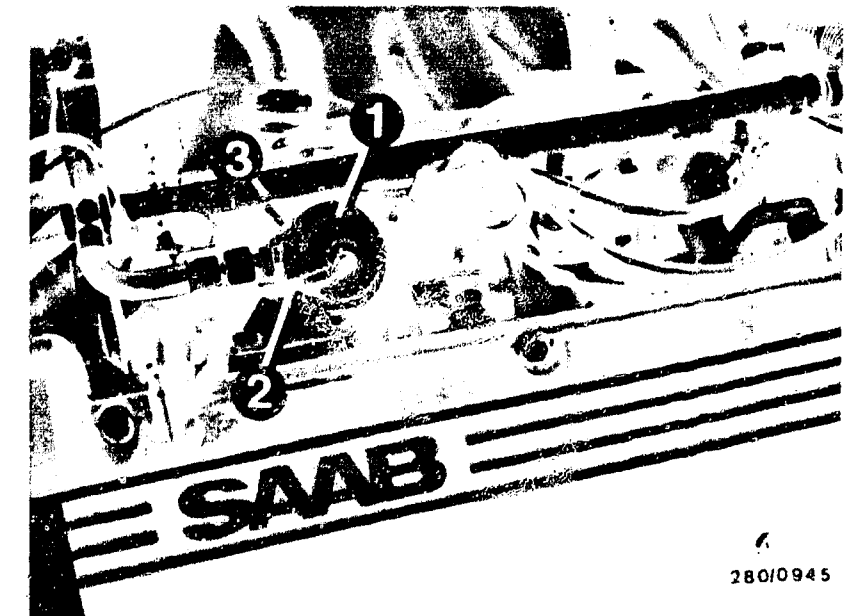
Middle illustration: 1 = Fuel filter until 7.85

Lower illustration: 1 = Fuel filter as of 8.85

yes

Continued on F7/F8

Continued on F1/F2



E22

Fuel pressure test  
Saab



E23

Fuel pressure test  
Saab





# Fuel pressure test (continued)

yes

## In-tank electric fuel pump Removal and installation

### ● Removal

- Disconnect the ground lead of the battery.
- Lift out the floor plate and the cover in the trunk compartment. Release the round cover above the in-tank electric fuel pump.
- Remove the cable connections on the in-tank electric fuel pump.
- Unscrew the cap nut. When so doing, hold the electric fuel pump with an open-end wrench, AF 17. Take off the inlet union of the fuel line. (Figure at center).

### Caution!

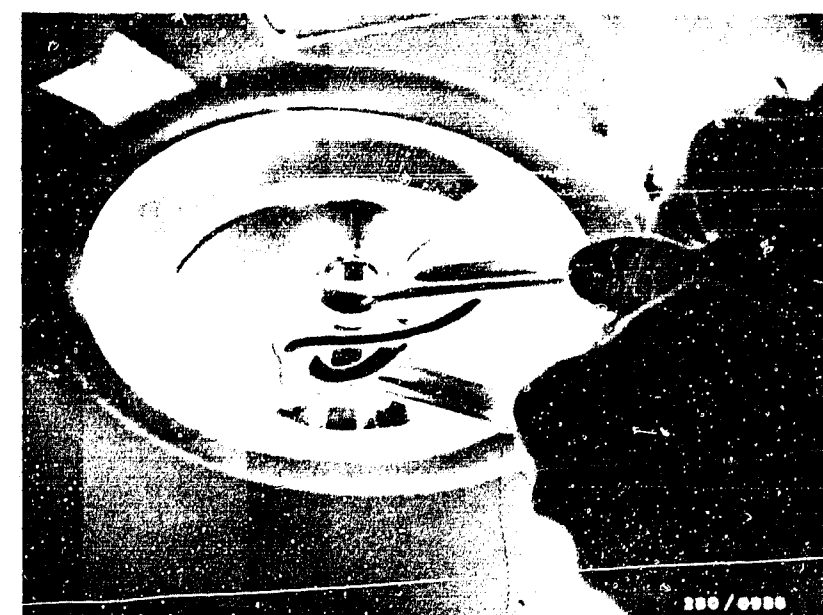
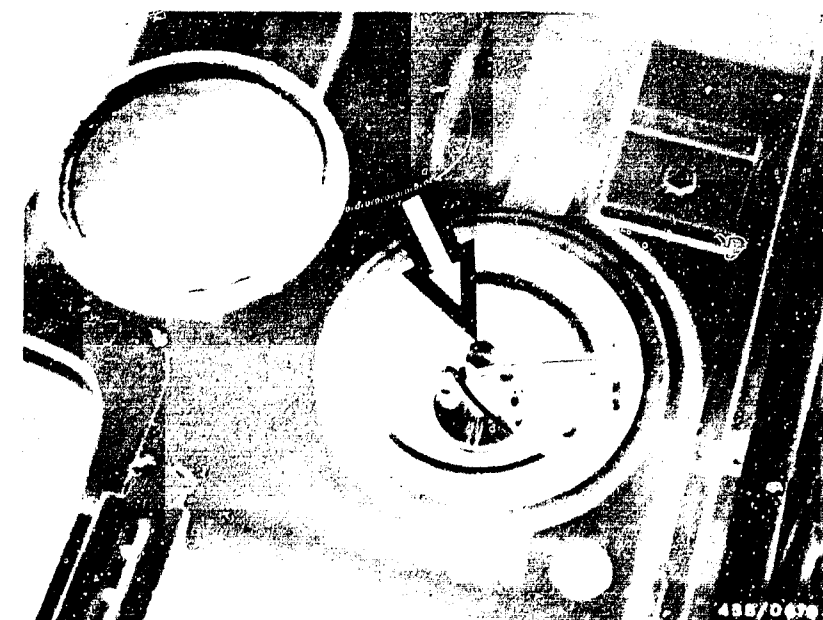
When unscrewing the fuel delivery line, make certain that no fuel can escape. Take suitable actions. (Carefully pinch off the fuel delivery line.)

### Fire hazard!

- Release the brackets of the in-tank electric fuel pump holder using a flexible screwdriver (through the assembly opening). (See figure at bottom.)

Continued on F7/F8

Continued on F3/F4



F1

Fuel pressure test  
Saab



F2

Fuel pressure test  
Saab



# Fuel pressure test (continued)

yes

yes

- Lift the in-tank electric fuel pump out.
- Release the cable clamps for the intake filter and the clamps for the rubber mounting (figure at center - arrows) and take both parts off the electric fuel pump.
- Shove the intake filter all the way on the intake fitting of the new electric fuel pump, and temporarily tighten the clamping band lightly.

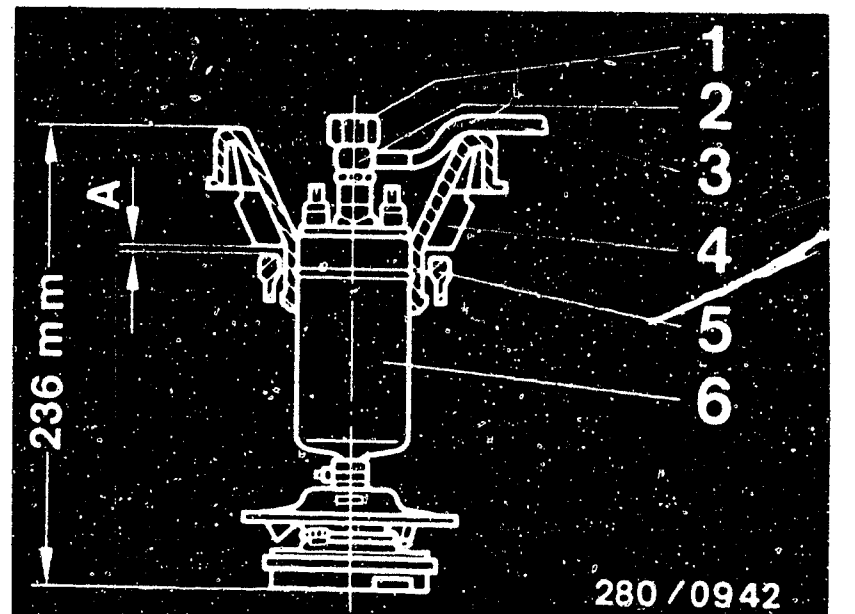
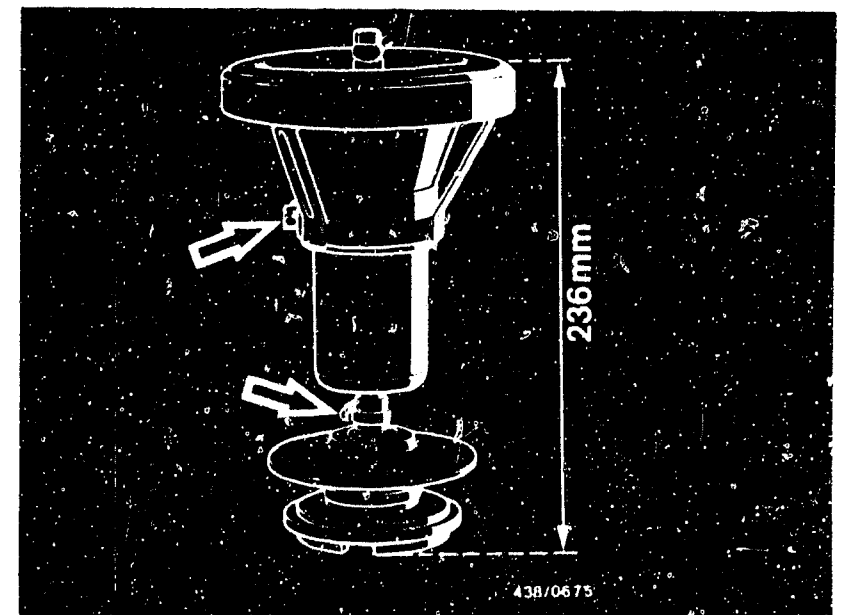
## ● Installation

Assemble the in-tank electric fuel pump to the mounting base in such a way that the vertical dimension between the lower edge of the intake filter and the upper edge of the rubber mounting is 236 mm. Attach the pump support and the brackets in such a way that dimension  $A = 2...6$  mm.

- 1 = Cap nut
- 2 = Non-return valve
- 3 = Fuel line
- 4 = Pump support
- 5 = Bracket
- 6 = Electric fuel pump

Continued on F7/F8

Continued on F5/F6



**F3**

Fuel pressure test  
Saab



**F4**

Fuel pressure test  
Saab



# Fuel pressure test (continued)

yes

- Check whether the fuel return line is attached to the splash tank at the base of the fuel tank (figure at top - arrow).
- Put the entire in-tank electric fuel pump into the fuel tank as follows:
  - Locate the positive lead terminal toward the left looking in the direction of forward vehicle travel.
  - Set up the intake filter inlet at an angle of 45° to the rear/right, looking in the direction of forward vehicle travel.

The rest of the installation takes place in reverse order.

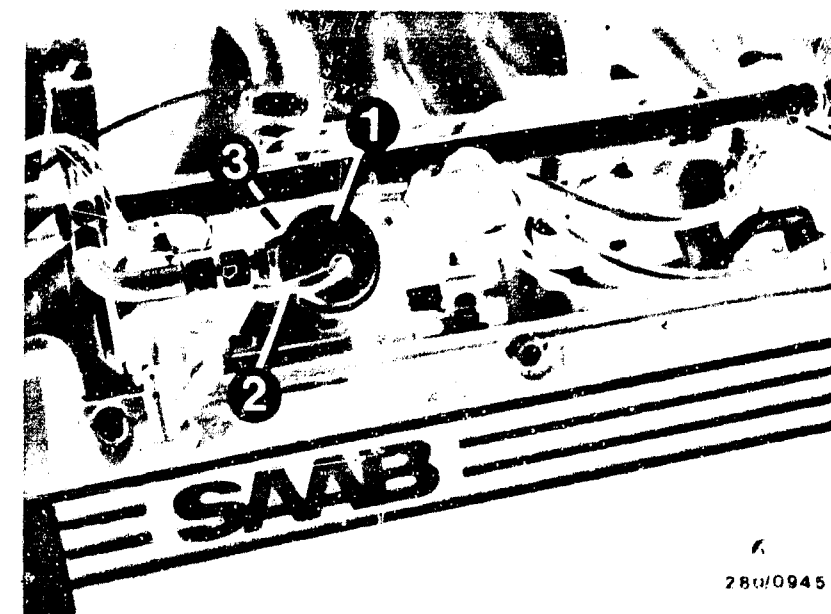
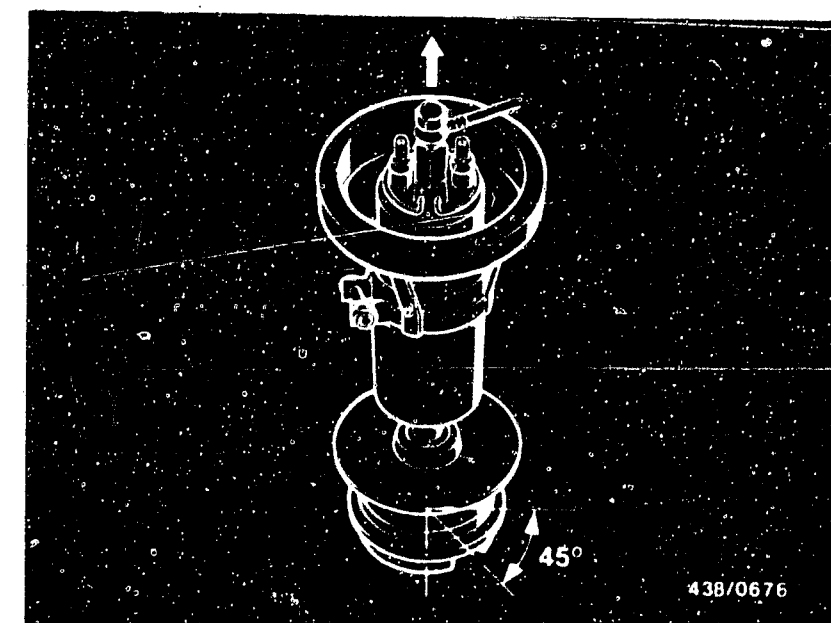
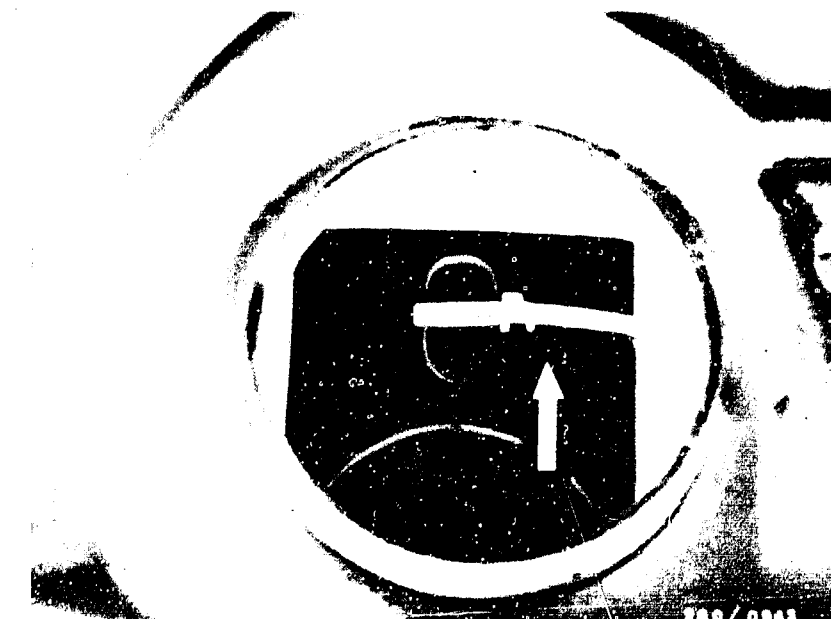
After testing and repair, the original condition of installation must be restored.

Fuel pressure of 2.7 bar (with pressure regulator 0 280 160 214...255) or 3.0 bar (with pressure regulator 0 280 160 264) is exceeded:

- The fuel return line (3) is clogged or pinched off.
- Take out and replace the pressure regulator (1).

yes

Continued on F7/F8



F5

Fuel pressure test  
Saab



F6

Fuel pressure test  
Saab



# Fuel pressure test (continued)

yes

Is the fuel pressure OK?

Pressure regulator:  
0 280 160 214, ..255

• Test specification:  
2.3 ... 2.7 bar

Pressure regulator:  
0 280 160 264

• Test specification:  
2.6 ... 3.0 bar

Is the test specification being met?

no

The fuel pressure drops off quickly after the hot engine is shut off.

• Check the fuel system for leaks. (Build up the fuel pressure.):

Fuel pressure  
0 280 160 214, ..255      2.3 ... 2.7 bar  
0 280 160 264              2.6 ... 3.0 bar

Disconnect the auxiliary lead and watch the pressure gauge.

The fuel pressure must still be min 1.0 bar after approx. 20 mins.

If not:

- Check the connections between the components and the fuel hoses and lines for leaks.
- Pressure regulator (diaphragm).
- Solenoid-operated fuel-injection valves (Needle seat, valve is not closing correctly.)
- Fuel filter is leaking.
- Electric fuel pump (leaking non-return valve). Use parts kit 1 587 010 006.

Upper illustration

1 = Pressure gauge

3 = Pressure regulator

Center illustration until 7.85

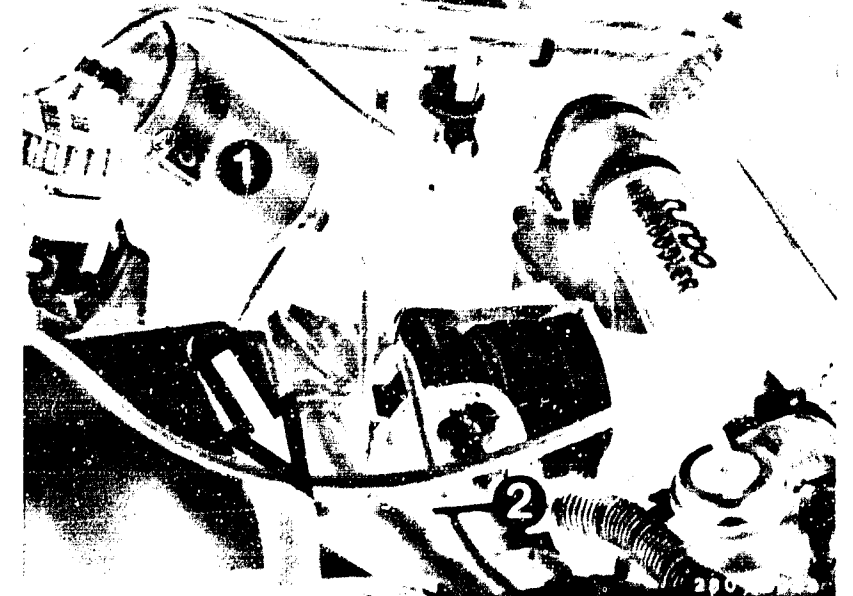
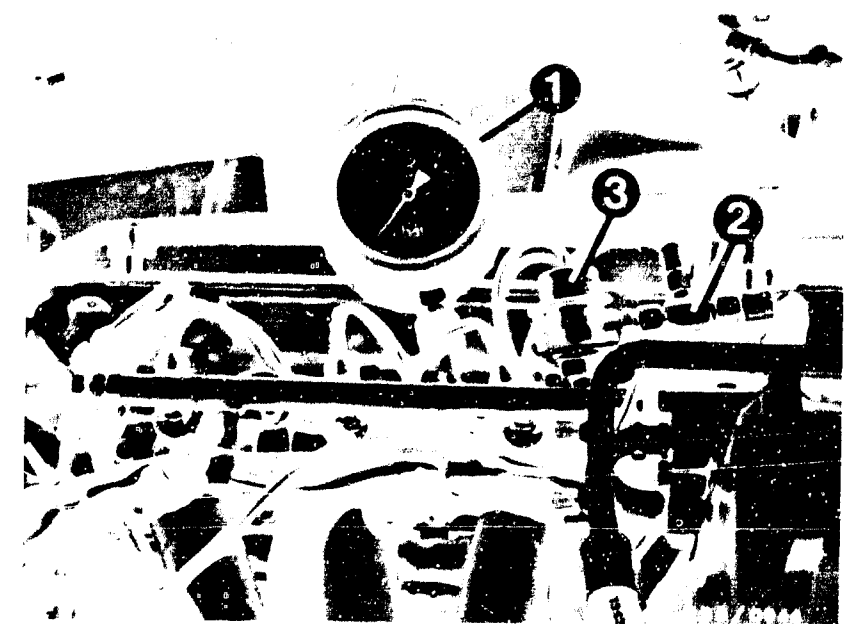
1 = Fuel filter

Lower illustration as of 8.85

1 = Fuel filter

yes

Continued on F9/F10



F7

Fuel pressure test  
Saab



F8

Fuel pressure test  
Saab



## Fuel pressure test (continued)

yes

Is the non-return valve of the in-tank electric fuel pump free of leaks?

no

### ● Removal and installation

yes

Continued on F11/F12

### ● Removal of the non-return valve

- Disconnect the ground lead of the battery.
- Lift out the floor plate and the cover in the trunk compartment. Release the round cover above the in-tank electric fuel pump.
- Remove the lead connections on the in-tank electric fuel pump.
- Unscrew the cap nut. When so doing, hold the electric fuel pump with an open-end wrench, AF 17. Take off the inlet union of the fuel line. (Figure at center).

### Caution!

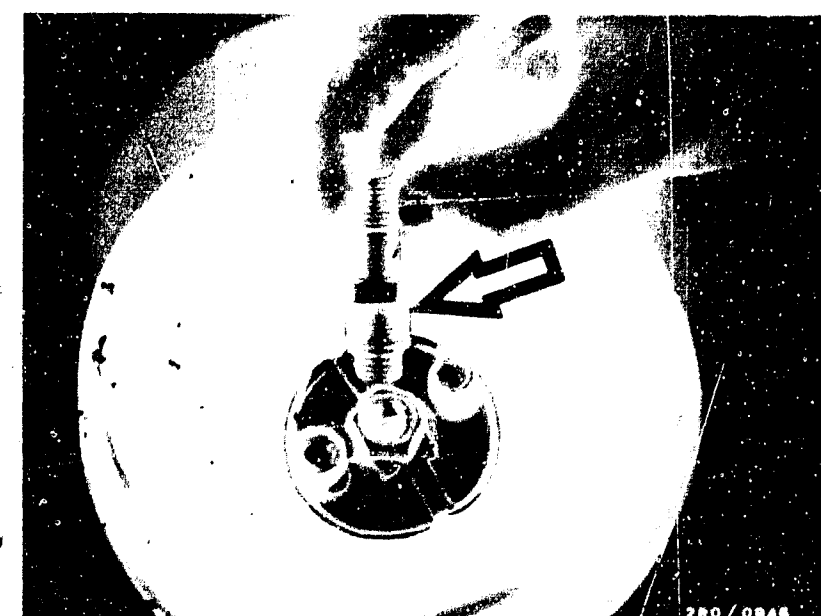
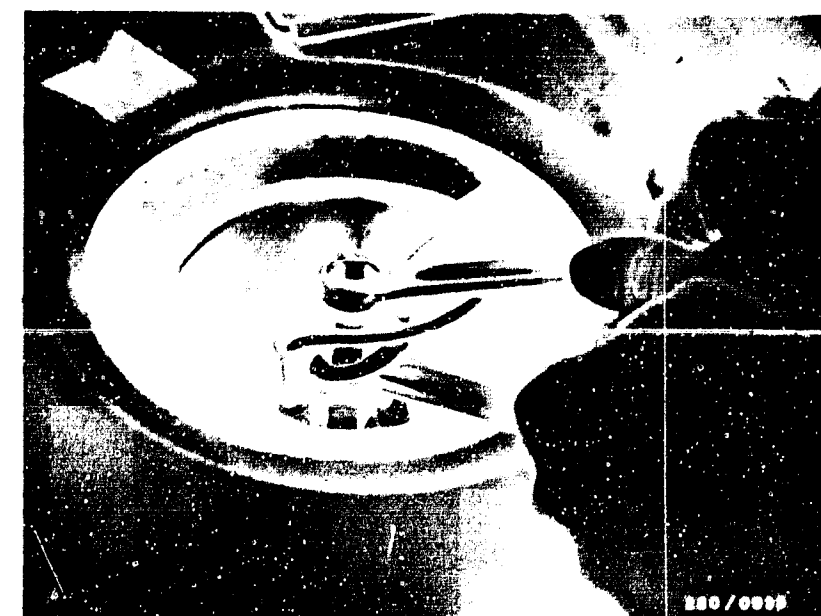
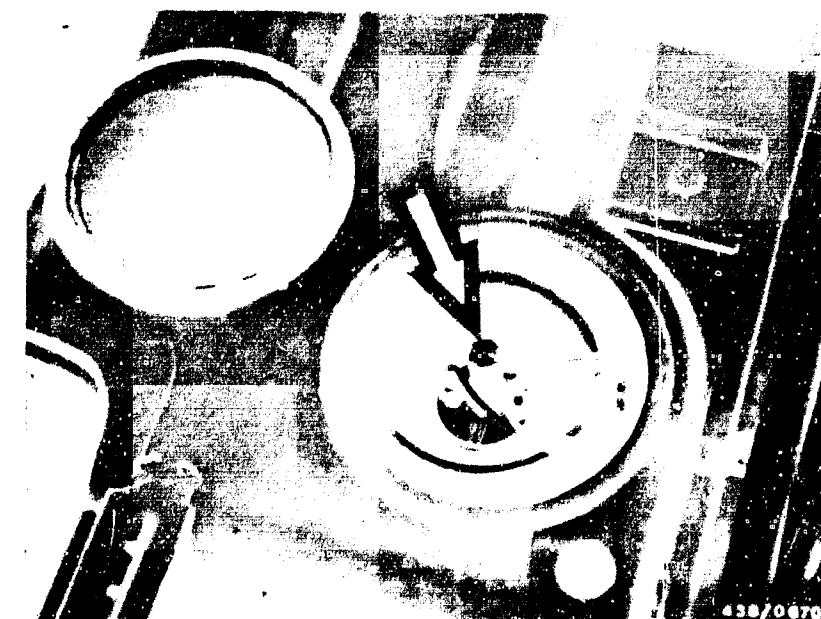
When unscrewing the fuel delivery line, make certain that no fuel can escape. Take suitable actions. (Carefully pinch off the fuel delivery line.)

### Fire hazard!

- Release the inlet union with the built-in non-return valve (figure at bottom - arrow) (1 587 010 006).
- Hold in-tank electric fuel pump with an open-end wrench.

### ● Installation takes place in reverse order.

Tightening torque for the non-return valve:  
10...16 Nm



**F9**

Fuel pressure test  
Saab



**F10**

Fuel pressure test  
Saab



## Fuel pressure test (continued)

yes

Take out the pressure gauge.

Restore the connection between the fuel delivery line and the fuel distribution pipe.

Remove the jumper cable, and the auxiliary lead and reconnect the plug-in connections.

### Caution!

After testing, restore the original condition of installation.

The fuel pressure test has been completed.

If the defect has not been located, or if additional instructions are needed for correction of the defect, proceed according to the trouble-shooting plan you have selected.

Detailed trouble-shooting plan  
(Coordinates C3...C4)

Targeted trouble-shooting plan  
(Coordinates C5...C7)

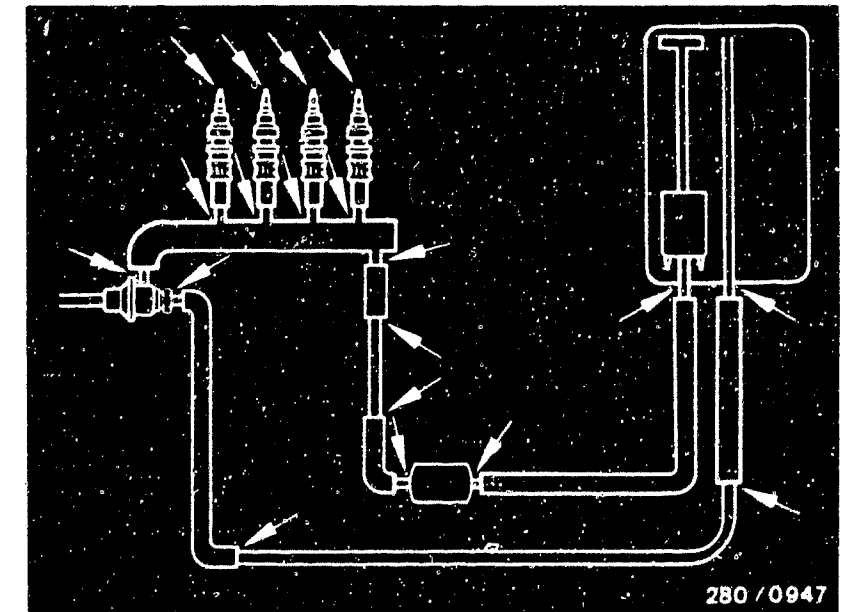


Diagram of fuel lines  
Arrows show connections between hoses and components.

**F11**

Fuel pressure test  
Saab



**F12**

Fuel pressure test  
Saab



## STARTING MOTOR TURNS, ENGINES DOES NOT START OR STARTS ONLY WITH DIFFICULTY

### Trouble-shooting program according to customer complaint

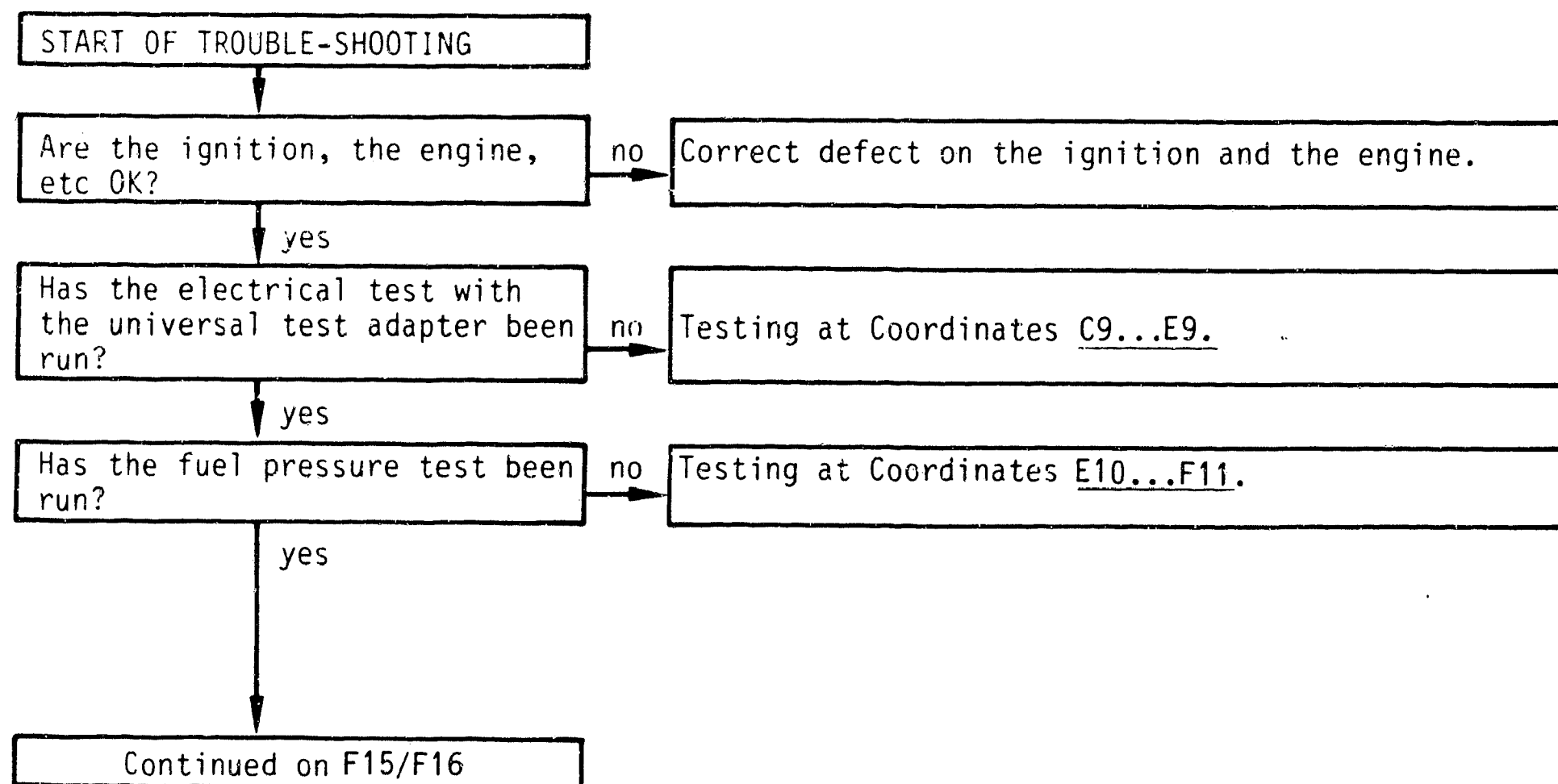
#### How to use the trouble-shooting program

Testing has been organized into 3 columns of boxes:

- In the column at the left are the questions for the tests being run.
- In the column at the center are descriptions of the tests and settings on components.
- The column at the right contains the illustrations that go with the text, and the legend for items in the illustrations.

If it is possible to answer the questions clearly with "yes" even without testing, proceed to the next question below.

If, on the other hand, the answer to the question is "no" and a defect is suspected, you must shift to the column at the center and run the tests indicated there. On completion of the testing, the trouble-shooting is continued at that point at which the shift was made earlier.



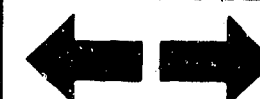
**F13**

Engine does not start  
Saab



**F14**

Engine does not start  
Saab





Starting motor turns, engine does not start or starts only with difficulty

yes

Is the start control OK?  
(Control unit function)

- Connect the test lead between one solenoid-operated fuel-injection valve
- Disconnect the plug from temperature sensor II (engine)(blue plug).

Plug in temperature sensor 0 280 130 028 (plug color black).

- Connect the motortester or multimeter to the test lead (setting V, scale 10 V).

- Take out pump fuse No. 30.

- Connect ignition lead Term. 4 from the ignition distributor to ground via a spark gap.

Start the engine.

Does the value for voltage on the solenoid-operated fuel-injection valve drop off from approx. 2 V to approx. 0.8 V during starting?

(With the engine at normal operating temperature, or with NTC II plug plugged in, the value for voltage is less than 0.5 V).

After testing, restore the original condition of installation.

yes

Continued on F19/F20

no

### Functional test

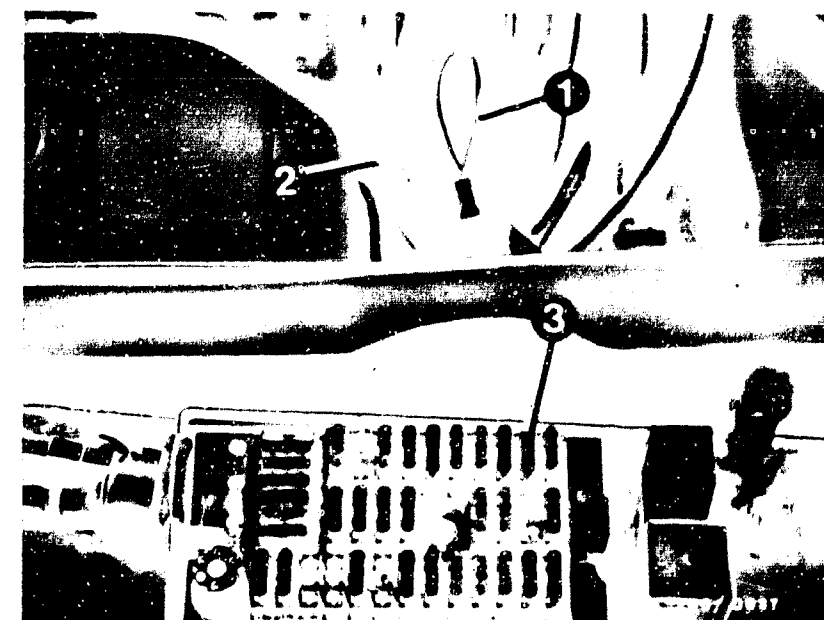
- Take out pump fuse No. 30 (in the central fuse box on the left fender).

- Disconnect ignition lead Term. 4 from the ignition distributor cap and connect to vehicle ground via a spark gap.  
(Caution! The engine must not start.)

### Caution!

When using spark gap EF 1177/7 1 684 531 000, an interference-suppression resistor of at least 2 k $\Omega$ , e.g. sleeve-type suppressor (5 k $\Omega$ ) 0 356 500 001, must be connected between the spark gap and ignition coil term. 4 in order to prevent the destruction of the control unit.

Continued on F17/F18



3 = Pump fuse

1 = Spark gap

EFAW 106A

1 681 100 001

2 = 5 k $\Omega$  sleeve-type suppressor

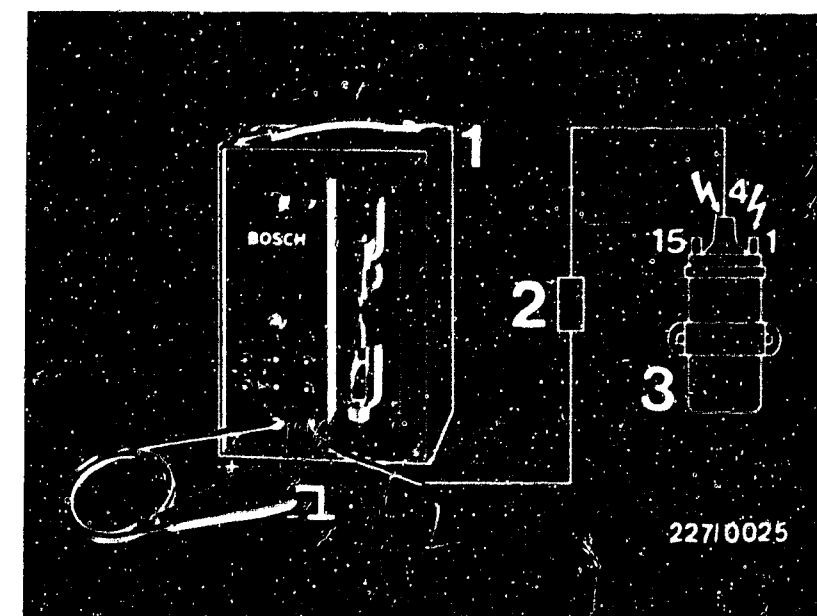
3 = Ignition coil

Caution!

Hazardous voltages

(400 V - 25 kV)

at terms. 1 and 4



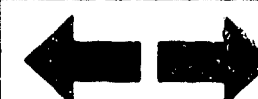
F15

Engine does not start  
Saab



F16

Engine does not start  
Saab





Starting motor turns, engine does not start or starts only with difficulty (continued)

yes

Continued on F19/F20

- Put in two-pin adapter lead 1 684 463 093 between one solenoid-operated fuel-injection valve and its electrical connecting lead.
- Connect a multimeter or motortester to the free measuring poles. Measuring scale approx. 10 V.
- Pull cable plug from temperature sensor II (engine) (blue plug) and connect temperature sensor 0 280 130 028 (black plug).

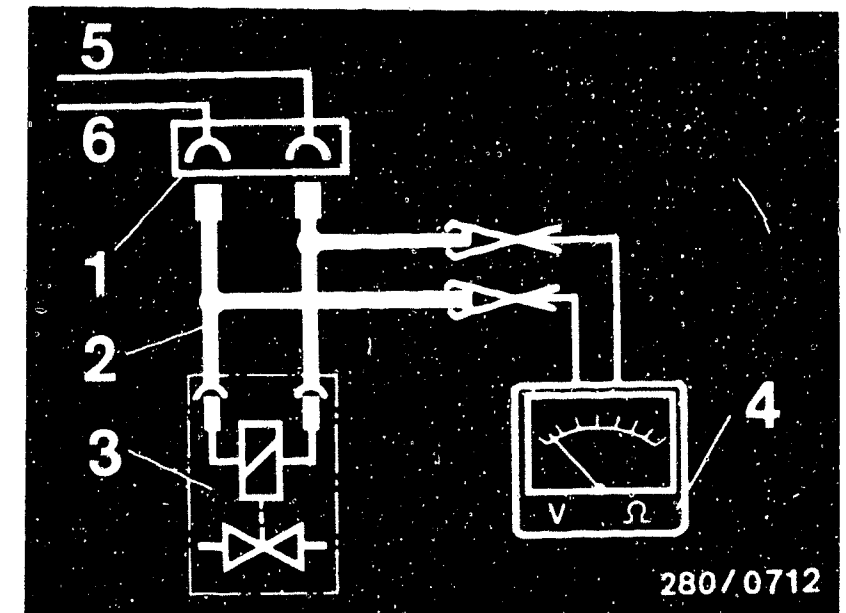
#### Measurement

- Start the engine.
- Reading for voltage drops from an initial approx. 2 V to approx. 0.8 V within approx. 10 secs starting time.  
If these values for voltage are not attained, take out and replace the control unit.
- The voltage test cannot be repeated until after approx. 1 minute.
- Connect cable plug to series temperature sensor. When engine is at operating temperature start → voltage reading smaller than 0.5 V.

If not, take out and replace temperature sensor II.

#### Caution!

After testing, restore the original condition of installation.

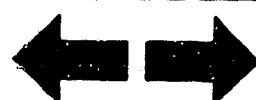


- 1 = Connection plug for the solenoid-operated fuel-injection valve lead.
  - 2 = Test lead 1 684 463 093
  - 3 = Solenoid-operated fuel-injection valve
  - 4 = Multimeter or motortester
  - 5 = From pump relay Term. 87
  - 6 = From control unit Term. 13
- 
- 1 = Temperature sensor II (engine) on the engine block (blue plug)



**F17**

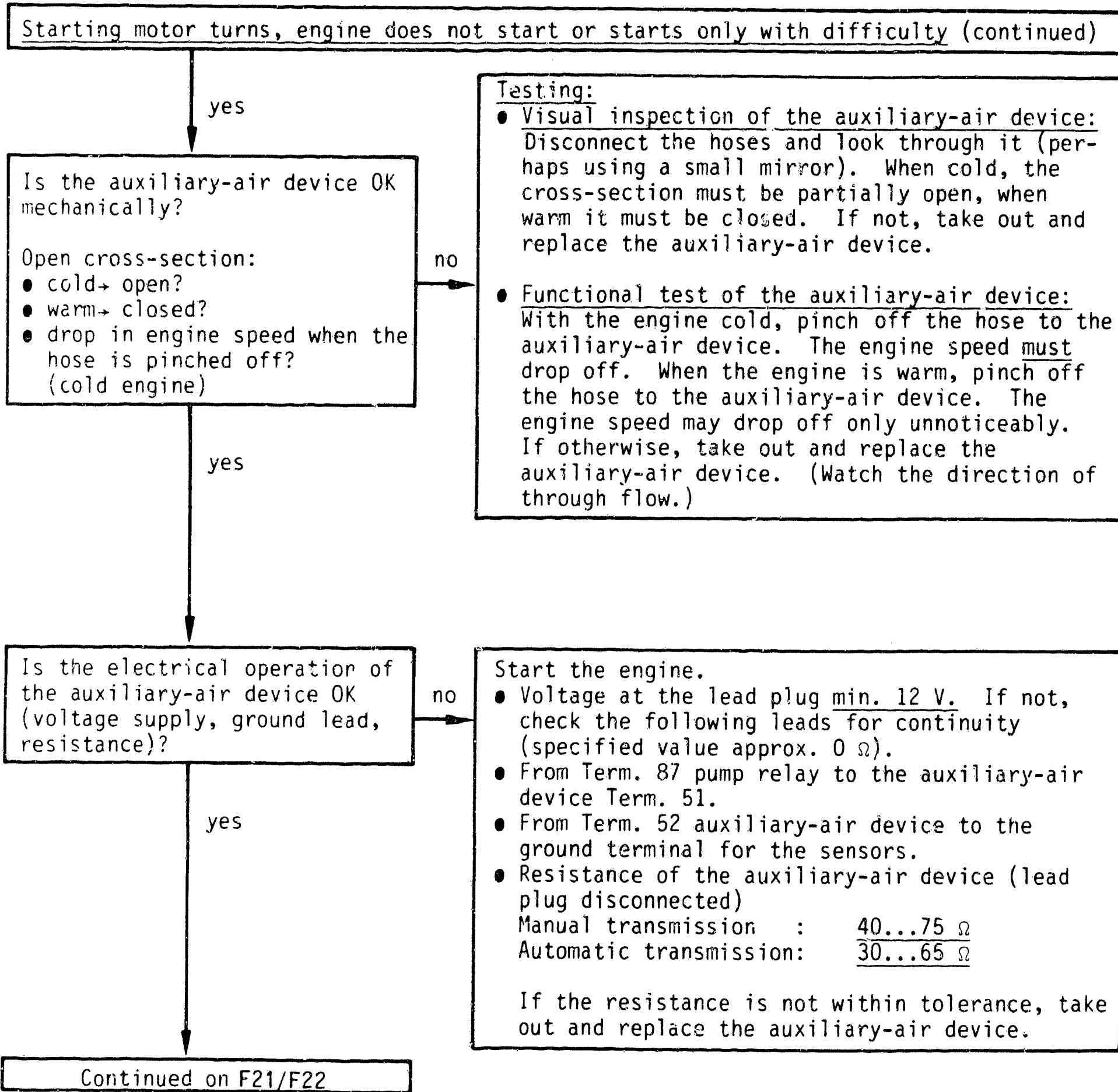
Engine does not start  
Saab



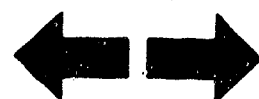
**F18**

Engine does not start  
Saab





Arrow = auxiliary-air device



Starting motor turns, engine does not start or starts only with difficulty (continued)

yes

Is the hot-wire air-mass sensor OK mechanically and electrically?

- Hot wire unbroken?
- Resistances within tolerance?

Between Term. 6 and Term. 3:

0...1100  $\Omega$

Between Term. 5 and Term. 3:

3.6...4.1  $\Omega$

no

#### Removal

- Release both clamps on the air filter.
- Release the hose clamp on the other side of the hot-wire air-mass sensor. Take out the hot-wire air-mass sensor.

#### Testing

##### • Visual inspection

- Is the connection plug put on correctly, the spring clamp snapped in, the plug free of twisting, with no plug prongs shoved back or poor contact. Watch for correct seating of the seal in the connecting plug.
- The wire screen OK on both sides?
- Is the hot wire broken? If yes, take out and replace the hot-wire air-mass sensor.

##### • Electrical test

- Disconnect connection plug. Set multimeter or motortester at  $\Omega$ -range.

#### Measurement of resistance

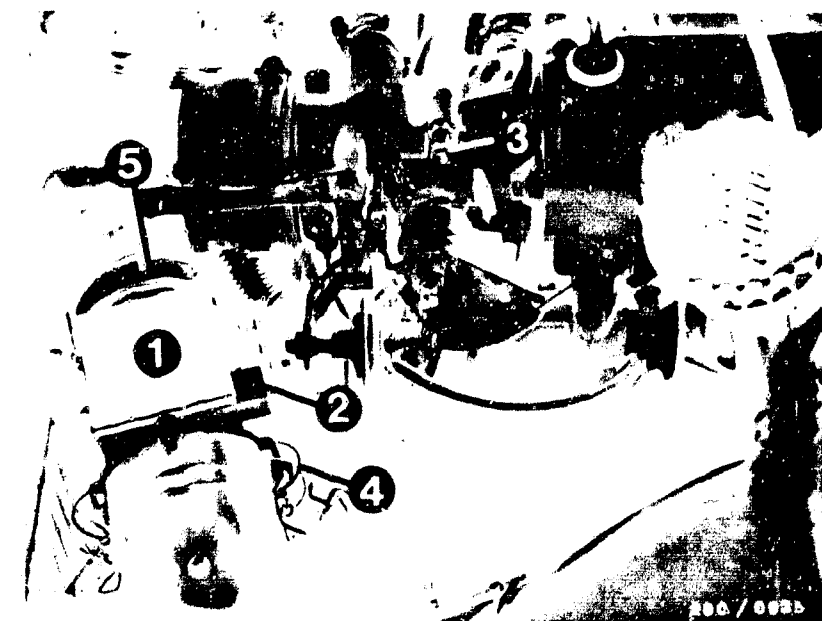
between Term. 6 and Term. 3: 0...1100  $\Omega$

between Term. 5 and Term. 3: 3.6...4.1  $\Omega$

If there are deviations, take out and replace the hot-wire air-mass sensor.

#### Installation

- Connection plug put on correctly (good contact).
- Fasten the clamps.
- Put on the hoses, and tighten the hose clamps on the hot-wire air-mass sensor. (Watch for tight seals at the connections - unmetered air)



- 1 = Hot-wire air-mass sensor
- 2 = Potentiometer for idle-mixture adjustment
- 4 = Clamps
- 5 = Hose clamps

yes

Continued on F23/F24

**F21**

Engine does not start

Saab



**F22**

Engine does not start

Saab



Starting motor turns, engine does not start or starts only with difficulty (continued)

yes

This test is no longer applicable as of 8.84.

Hot start.

Does the engine fail to start when starting with the accelerator pedal to the floor? (full-load contact closed)

no

When starting, the fuel supply is switched off if the accelerator pedal is pressed to the full-load position.

Improvement of hot-start behavior:

Push down only approx. half-way on the accelerator (The full-load contact must not close!) and start the engine.

yes

Continued on G1/G2

**F23**

Engine does not start  
Saab



**F24**

Engine does not start  
Saab



Starting motor turns, engine does not start or starts only with difficulty (continued)

yes

Are all hose lines and electrical lead connections correctly put on?  
Visual inspection.  
Has the intake system been checked for leaks?

no

Check that the hoses for the air intake system and the fuel line system have been put on correctly, without kinking or damage. If need be, take out and replace hoses. Correct leaks by using new seals or by tightening the connecting screws.

Checking for leaks

Seal off the exhaust pipe, unscrew the hose from the air filter to the air-mass sensor at the air-mass sensor and seal off the air-mass sensor channel (dust cover). Disconnect the hose after the auxiliary-air device. Seal off the auxiliary-air device connection. Using a compressed air gun (0.3 bar), blow into the hose to the intake manifold. In so doing, open the throttle valve all the way. Using soapy water, brush or spray all connections. Bubbling or foaming indicates leaks.

Caution!

Put all hoses back on and tighten hose clamps securely. Check for leaks.

yes

Checking the customer complaint

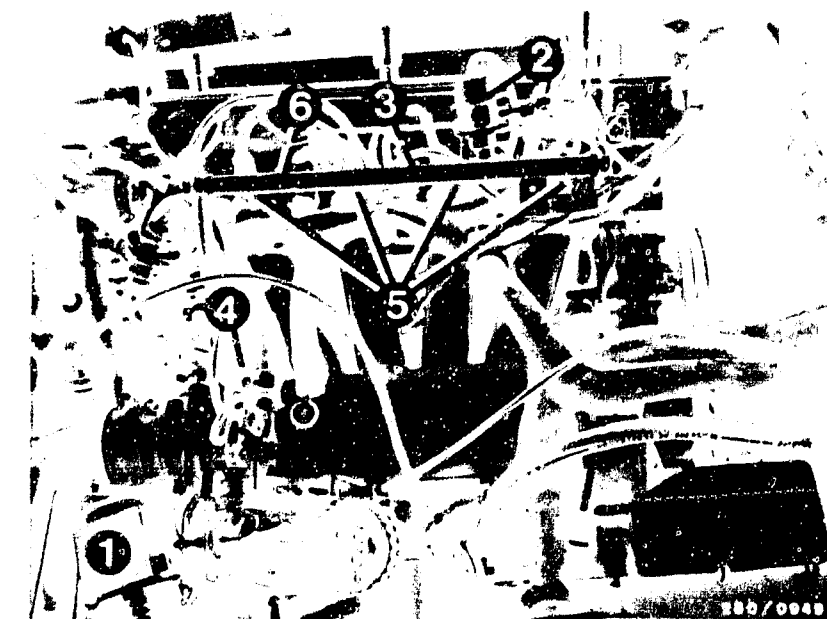
"Starting motor turns, engine does not start or starts only with difficulty,"

no

Other possible defects:

- The customer complaint has been incorrectly identified. (see Coordinates C3...C8.) If the defect has not been identified using the "targeted trouble-shooting," see "detailed trouble-shooting" (Coordinates C3/C4).
- Engine not OK mechanically (compression, valve setting, valve timing, wear on camshaft).

has been completed.  
Has the customer complaint been corrected?



- 1 = Hot-wire air-mass sensor
- 2 = Pressure regulator
- 3 = Temperature sensor II (engine)
- 4 = Throttle-valve switch
- 5 = Solenoid-operated fuel-injection valve
- 6 = Ground terminal

G1

Engine does not start  
Saab



G2

Engine does not start  
Saab



## ENGINE STARTS AND THEN DIES

### Trouble-shooting program according to customer complaint

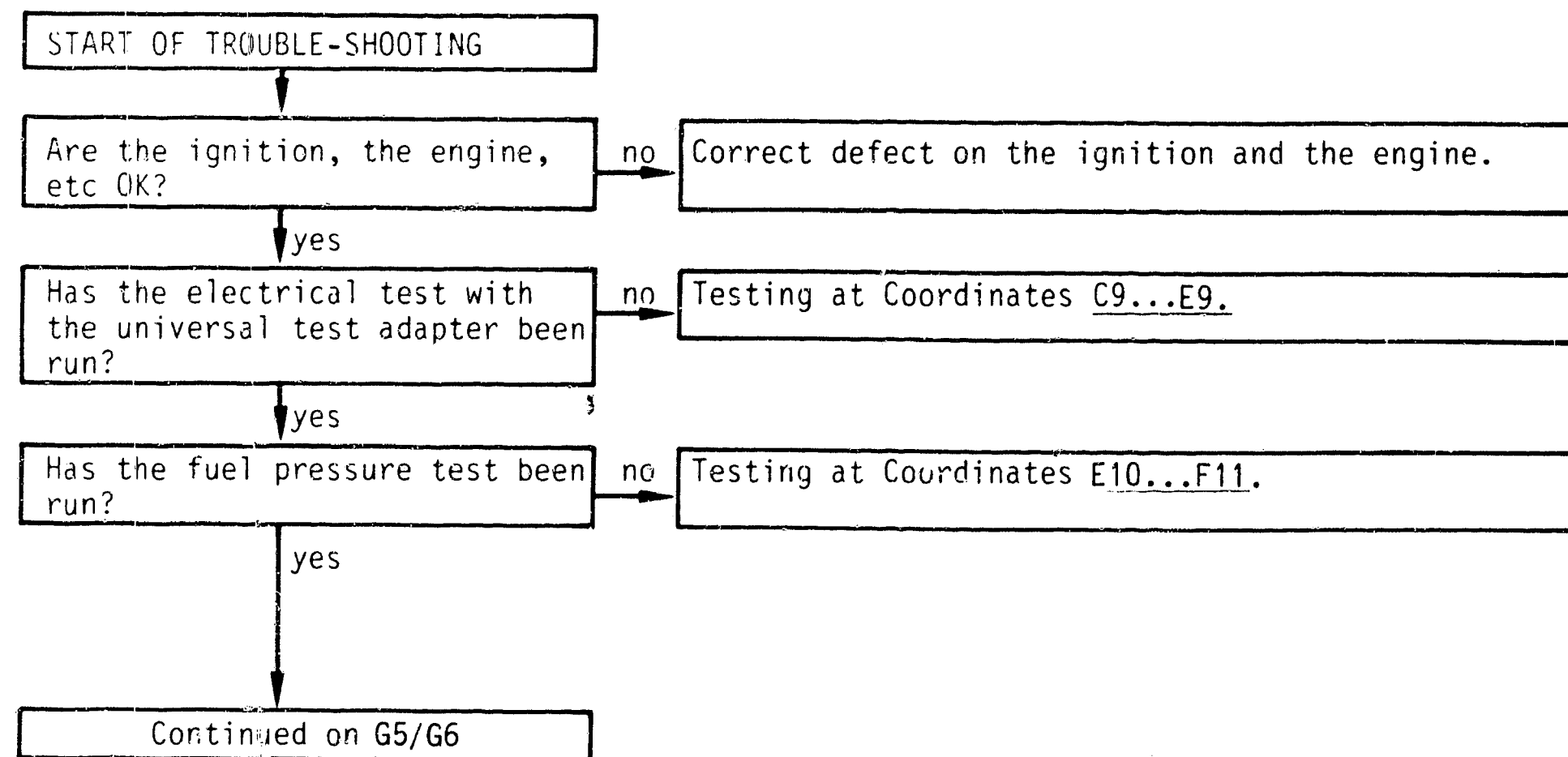
#### How to use the trouble-shooting program

Testing has been organized into 3 columns of boxes:

- In the column at the left are the questions for the tests being run.
- In the column at the center are descriptions of the tests and settings on components.
- The column at the right contains the illustrations that go with the text, and the legend for items in the illustrations.

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If, on the other hand, the answer to the question is "no" and a defect is suspected, you must shift to the column at the center and run the tests indicated there. On completion of the testing, the trouble-shooting is continued at that point at which the shift was made earlier.



**G3**

Engine starts and then dies  
Saab



**G4**

Engine starts and then dies  
Saab



Engine starts and then dies (continued)

yes

Is the auxiliary-air device OK mechanically?

Open cross-section:

- cold → open?
- warm → closed?
- drop in engine speed when the hose is pinched off? (cold engine)

no

Testing:

- Visual inspection of the auxiliary-air device: disconnect the hoses and look through it (perhaps using a small mirror). When cold, the cross-section must be partially open, when warm it must be closed. If not, take out and replace the auxiliary-air device.
- Functional test of the auxiliary-air device: With the engine cold, pinch off the hose to the auxiliary-air device. The engine speed must drop off. When the engine is warm, pinch off the hose to the auxiliary-air device. The engine speed may drop off only unnoticeably. If otherwise, take out and replace the auxiliary-air device. (Watch the direction of through flow.)

yes

Is the electrical operation of the auxiliary-air device OK (voltage supply, ground lead, resistance)?

no

Start the engine.

- Voltage at the lead plug min. 12 V. If not, check the following leads for continuity (specified value approx. 0  $\Omega$ ).
- From Term. 87 pump relay to the auxiliary-air device Term. 51.
- From Term. 52 auxiliary-air device to the ground terminal for the sensors.
- Resistance of the auxiliary-air device (lead plug disconnected)  
Manual transmission : 40...75  $\Omega$   
Automatic transmission: 30...65  $\Omega$

If the resistance is not within tolerance, take out and replace the auxiliary-air device.

yes

Continued on G7/G8



Arrow = auxiliary-air device

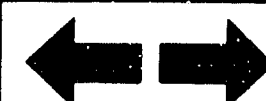
G5

Engine starts and then dies  
Saab



G6

Engine starts and then dies  
Saab





Engine starts and then dies (continued)

Are the solenoid-operated fuel-injection valves OK with regard to leaks?

yes

yes

Continued on G11/G12

no

Checking the solenoid-operated fuel-injection valves for leaks:

- Take out the fuel distribution pipe and the solenoid-operated fuel-injection valves:
  - Release the fastening screws on the fuel-distribution pipe and the pressure regulator.
  - Carefully pull all 4 solenoid-operated fuel-injection valves out of the cylinder head at the same time.
- Build up the fuel pressure:
  - Disconnect the control unit plug on the LH-control unit.
  - Make an auxiliary lead (lead diameter 1.5 mm with blade terminals 6.3 mm at both ends).

Until 7.85:

- Disconnect 2-pin plug connection and connect auxiliary cable. This plug connection is between the brake power assist unit and the coolant overflow reservoir.
- As of 8.85:
- Pull out pump fuse no. 30 and hazard-warning and turn-signal system no. 27 and bridge with auxiliary cable.
  - Ignition "ON", in-tank electric fuel pump should operate.

• Test specification:

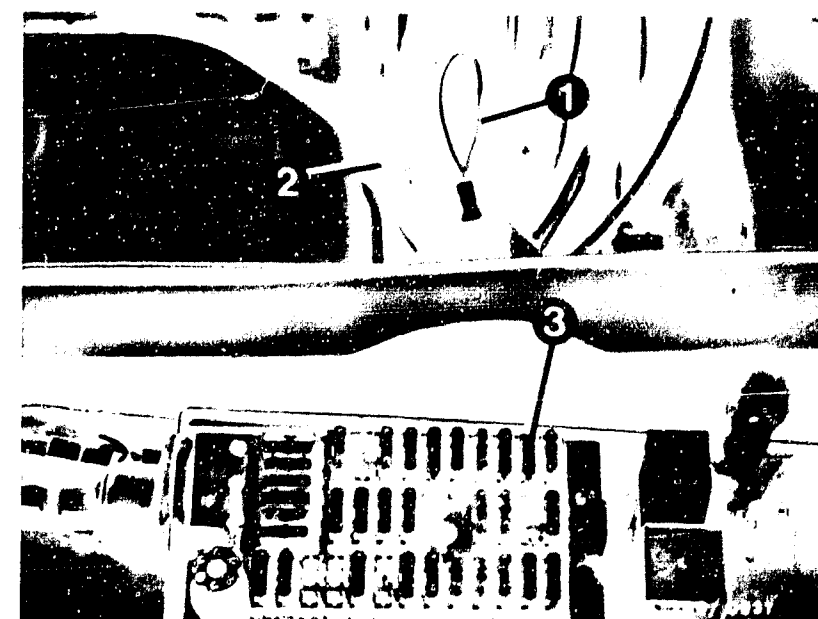
Within 60 sec. there must be no drop formation at mouth of solenoid-operated injection valve. In case of defect, replace injection valve.

Continued on G9/G10



1 = Fastening screw  
3 = Solenoid-operated fuel-injection valves

1 = Auxiliary lead  
2 = 2-pin plug connection  
3 = Pump fuse



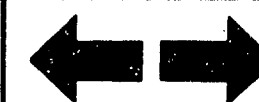
G7

Engine starts and then dies  
Saab



G8

Engine starts and then dies  
Saab





Engine starts and then dies (continued)

yes

Continued on G11/G12

● Removal

- Disconnect the electrical connection
- Carefully push the retaining bracket out of the slot
- Carefully pull the solenoid-operated fuel-injection valve out of the fuel distribution pipe.

Caution! Catch any fuel that runs out. Do not allow it to drip on hot portions of the engine.

● Installation

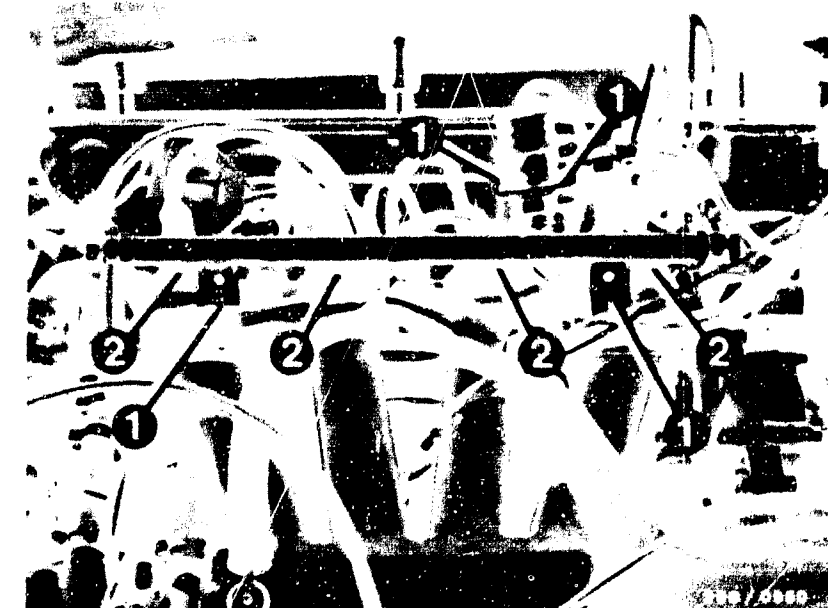
Caution!

Before installation, the two O-rings may be greased only lightly (silicone grease Ft 2 v 1). The other parts of the solenoid-operated fuel-injection valves must remain free of grease.

- Carefully put the new solenoid-operated fuel-injection valve on the fuel distribution pipe.
- Shove the retaining bracket into the slot on the solenoid-operated fuel-injection valve until the bracket latches. (Check the connection for leaks.)

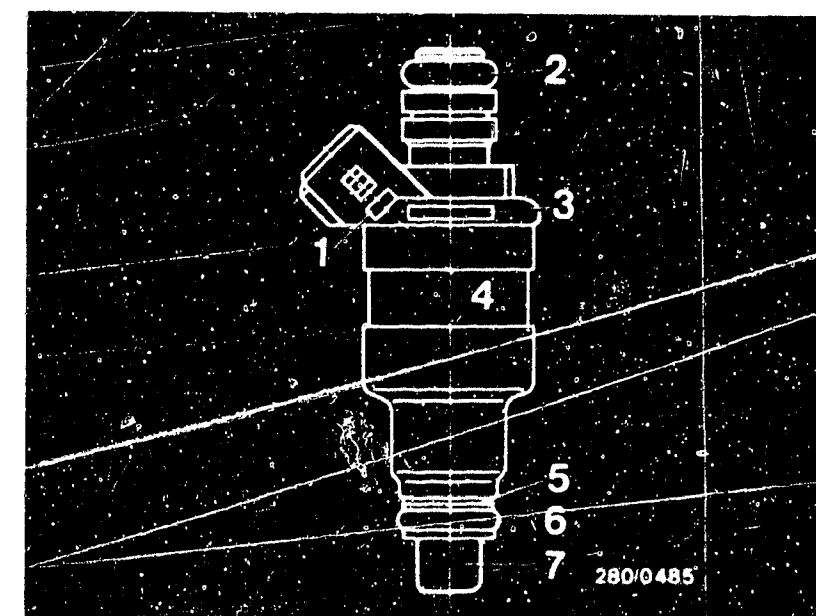
Caution!

After testing, restore the original condition of installation.  
Check for leaks (unmetered air).



1 = Fastening screws  
2 = Solenoid-operated fuel-injection valves

1 = FD-marking  
2 = Top O-ring  
3 = Part No.  
4 = Solenoid-operated fuel-injection valve  
5 = Supporting plate (yellow, 2 mm)  
6 = Bottom O-ring  
7 = Protective sleeve



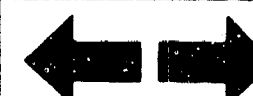
**G9**

Engine starts and then dies  
Saab



**G10**

Engine starts and then dies  
Saab



# Engine start and then dies (continued)

yes

Is the hot-wire air-mass sensor OK mechanically and electrically?

- Hot wire unbroken?
- Resistances within tolerance?

Between Term. 6 and Term. 3:  
0...1100  $\Omega$

Between Term. 5 and Term. 3:  
3.6...4.1  $\Omega$

no

## Removal

- Release both clamps on the air filter
- Release the hose clamp on the other side of the hot-wire air-mass sensor. Take out the hot-wire air-mass sensor.

## Testing

### • Visual inspection

- Is the connection plug put on correctly, the spring clamp snapped in, the plug free of twisting, with no plug prongs shoved back or poor contact. Watch for correct seating of the seal in the connecting plug.
- The wire screen OK on both sides?
- Is the hot wire broken? If yes, take out and replace the hot-wire air-sensor.

### • Electrical test

- Disconnect connection plug. Set multimeter or motortester at  $\Omega$ -range.

Measurement of resistance

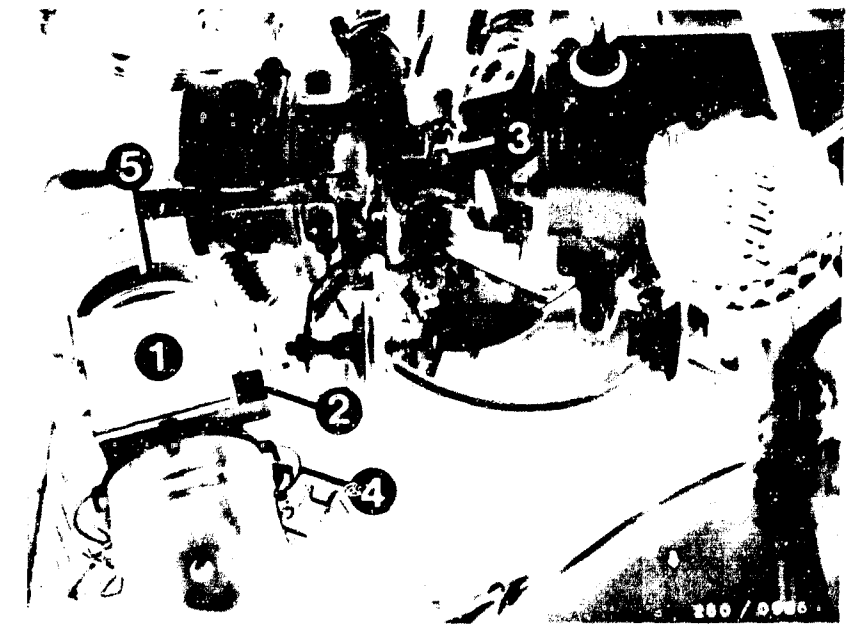
between Term. 6 and Term. 3: 0...1100  $\Omega$

between Term. 5 and Term. 3: 3.6...4.1  $\Omega$

If there are deviations, take out and replace the hot-wire air-mass sensor.

## Installation

- Connection plug put on correctly (good contact).
- Fasten the clamps.
- Put on the hoses, and tighten the hose clamps on the hot-wire air-mass sensor. (Watch for tight seals at the connections - unmetered air)



- 1 = Hot-wire air-mass sensor
- 2 = Potentiometer for idle-mixture adjustment
- 4 = Clamps
- 5 = Hose clamps

yes

Continued on G13/G14

G11

Engine starts and then dies  
Saab



G12

Engine starts and then dies  
Saab



# Engine starts and then dies (continued)

yes

Are all hose lines and electrical lead connections correctly put on?  
Visual inspection.  
Has the intake system been checked for leaks?

no

Check that the hoses for the air intake system and the fuel line system have been put on correctly, without kinking or damage. If need be, take out and replace hoses. Correct leaks by using new seals or by tightening the connecting screws.

## Checking for leaks

Seal off the exhaust pipe, unscrew the hose from the air filter to the air-mass sensor at the air-mass sensor and seal off the air-mass sensor channel (dust cover). Disconnect the hose after the auxiliary-air device. Seal off the auxiliary-air device connection. Using a compressed air gun (0.3 bar), blow into the hose to the intake manifold. In so doing, open the throttle valve all the way. Using soapy water, brush or spray all connections. Bubbling or foaming indicates leaks.

## Caution!

Put all hoses back on and tighten hose clamps securely. Check for leaks.

yes

Checking the customer complaint  
"Engine starts and then dies,"  
has been completed.  
Has the customer complaint been corrected?

no

## Other possible defects:

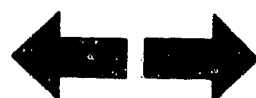
- The customer complaint has been incorrectly identified. (see Coordinates C3...C8). If the defect has not been identified using the "targeted trouble-shooting," see "detailed trouble-shooting" (Coordinates C3/C4).
- Engine not OK mechanically (compression, valve setting, valve timing, wear on camshaft).



- 1 = Hot-wire air-mass sensor
- 2 = Pressure regulator
- 3 = Temperature sensor II (engine)
- 4 = Throttle-valve switch
- 5 = Solenoid-operated fuel-injection valve
- 6 = Ground terminal

**G13**

Engine starts and then dies  
Saab



**G14**

Engine starts and then dies  
Saab



## ROUGH IDLE OR INCORRECT IDLE SPEED (continued)

### Trouble-shooting program according to customer complaint

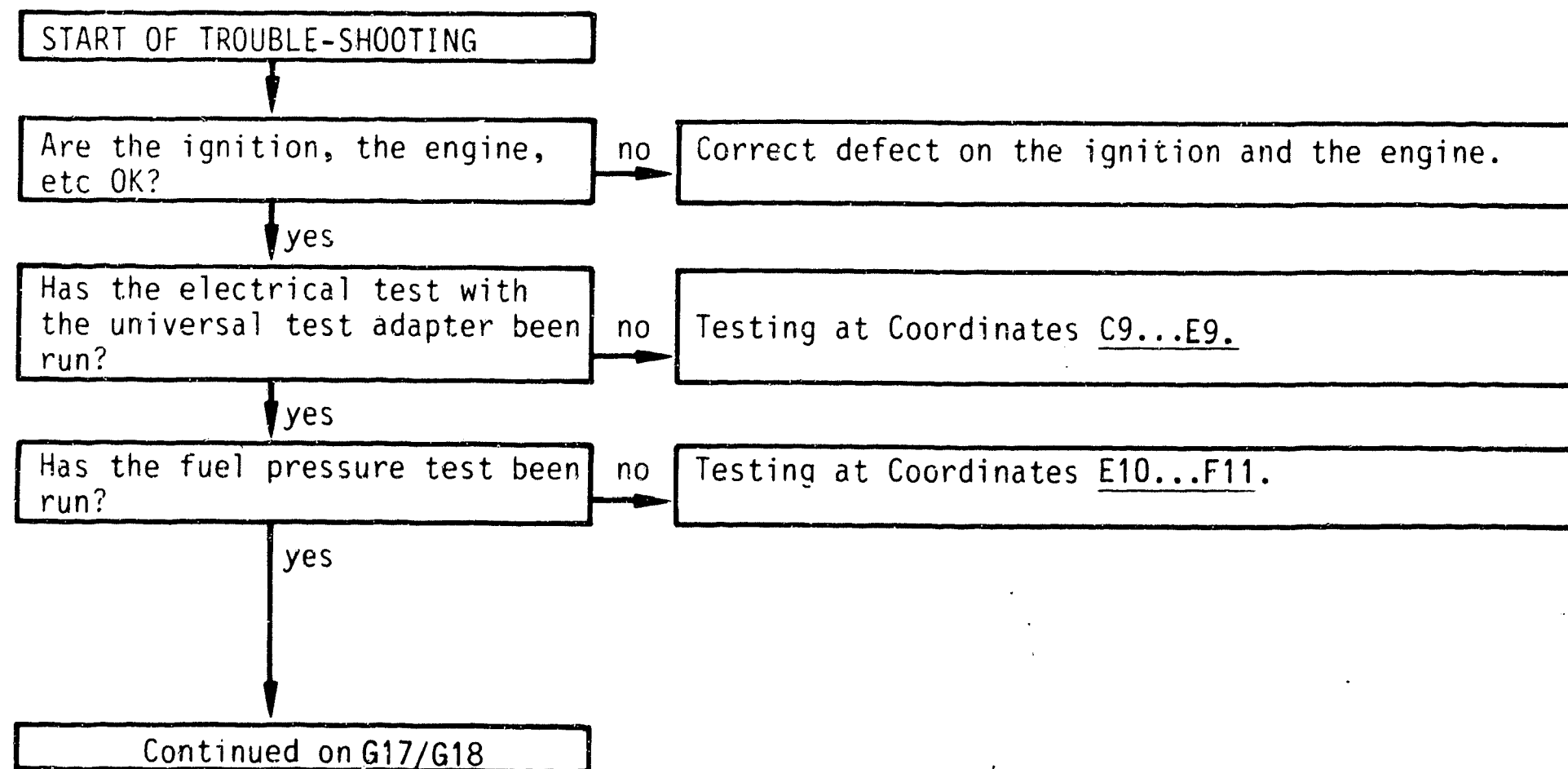
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Rough idle, incorrect idle speed (continued)

yes

Is the throttle valve closed?

- Does the throttle-valve lever strike against the stop screw?

no

yes

Continued on G19/G20

• Testing

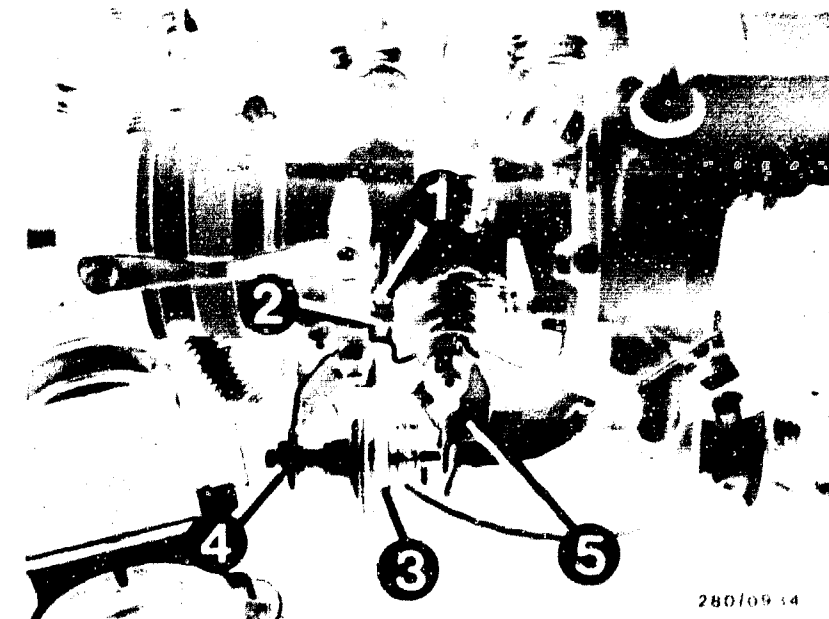
Find out whether it is possible to close the throttle valve even further, causing the engine speed to drop off.

• Throttle-valve adjustment:

- Check whether the throttle valve is centered in the throttle valve housing.
- Screw out the stop screw until there is no contact between the stop screw and the throttle-valve lever.
- Screw the stop screw in until the stop screw touches the throttle-valve lever.
- Then turn the stop screw 1/3 turn further in and secure the stop screw with a locking nut. This produces a clearance between the throttle valve and the throttle-valve housing of approx. 0.05 mm.

• Check the length of the accelerator cable:

- The accelerator cable length must be at least long enough so that the throttle valve is in the idle setting.
- No play in the accelerator cable.
- The throttle valve must be fully open when the accelerator pedal is to the floor.



280/09 34

- 1 = Throttle-valve stop screw
- 2 = Throttle-valve stop
- 3 = Throttle-valve damper
- 4 = Locking nut, for adjusting the throttle-valve damper
- 5 = Throttle-valve lever

G17

Rough idle  
Saab



G18

Rough idle  
Saab



# Rough idle, incorrect idle speed (continued)

yes

Is the mechanical throttle-valve damper OK?

- Testing
- Adjustment

no

## • Testing

- With the engine at normal operating temperature, set an idle speed of  $775...925 \text{ min}^{-1}$ .
- Increase the engine's speed to  $2000 \text{ min}^{-1}$ , and using a stopwatch, measure the time between releasing the accelerator pedal and reaching idle speed. The delay time must be between  $3...6 \text{ secs.}$

## • Adjustment

- Run the engine to normal operating temperature.
- Set the idle speed at  $775...925 \text{ min}^{-1}$  using the idle-speed adjusting screw.
- Release the locking nut on the throttle-valve damper.
- Increase engine speed to  $2000 \text{ min}^{-1}$ . Adjust the throttle-valve damper in such a way that it touches the throttle-valve lever. (Turning the throttle-valve damper toward the bracket = longer delay time. Turning the throttle-valve damper away from the bracket = shorter delay time.)
- Check the delay time. Increase the engine's speed to  $2000 \text{ min}^{-1}$ , and using a stopwatch, measure the time between releasing the accelerator pedal and reaching idle speed ( $775...925 \text{ min}^{-1}$ ). The delay time must be between  $3...6 \text{ secs.}$  Otherwise, take out and replace the throttle-valve damper.

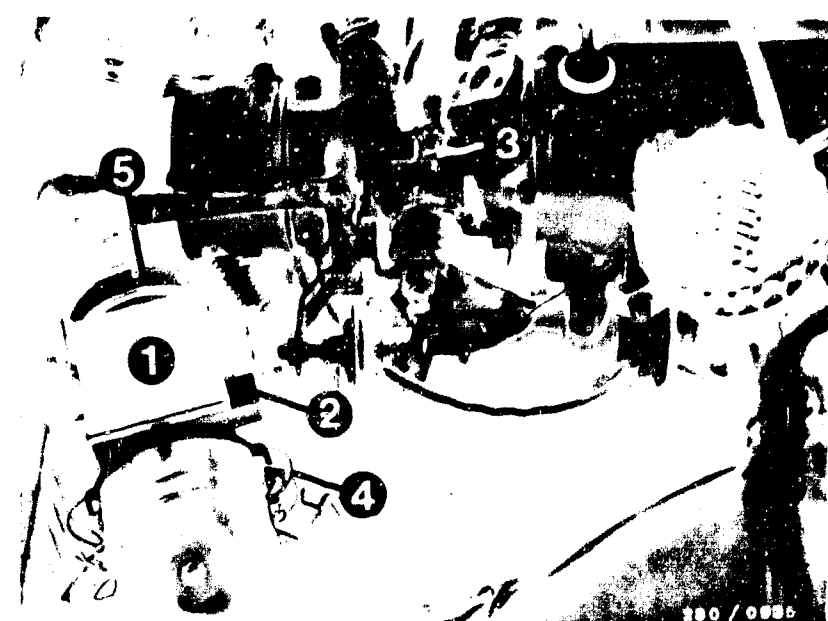
yes

Continued on G21/G22



- 3 = Throttle-valve damper
- 4 = Locking nut (for adjustment of the throttle-valve damper)
- 5 = Throttle-valve lever

3 = Idle-speed adjusting screw



G 19

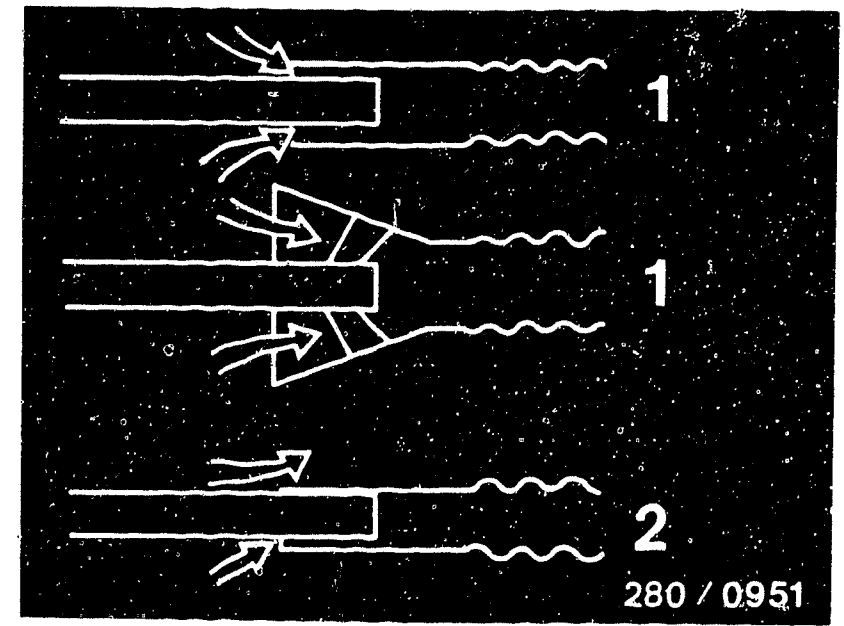
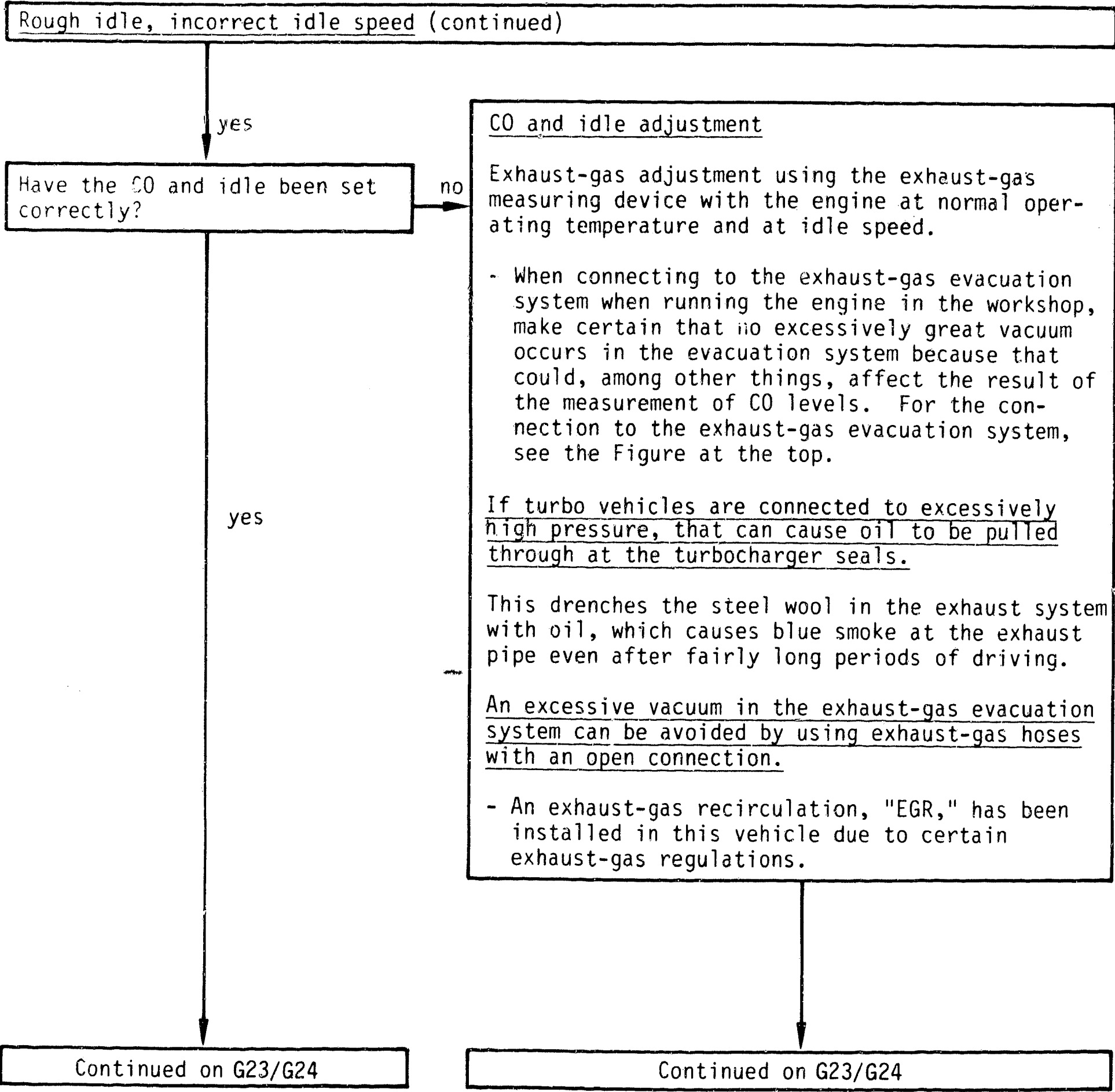
Rough idle  
Saab



G 20

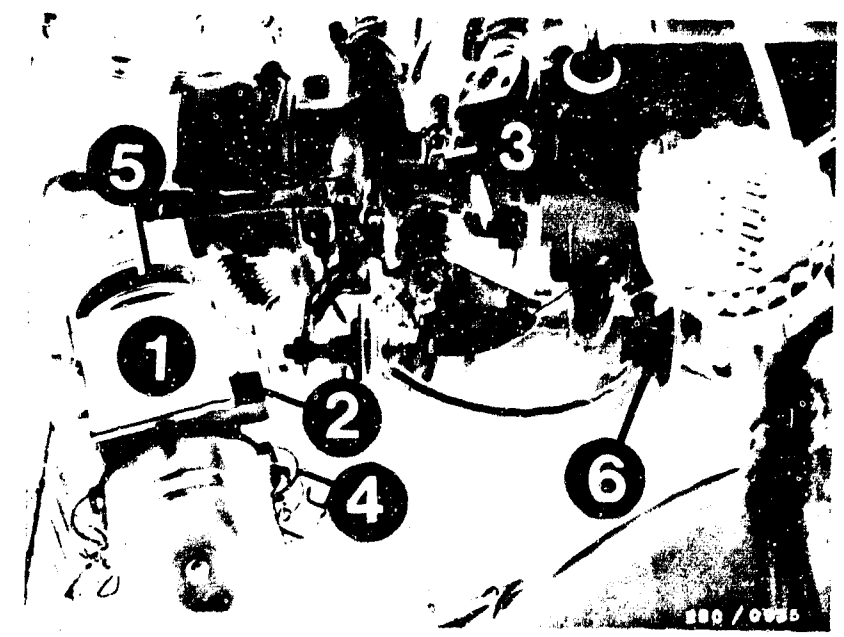
Rough idle  
Saab





1 = correct  
2 = incorrect

6 = (Exhaust-gas) recirculation valve



# Rough idle, incorrect idle speed (continued)

yes

Are the idle speed and CO-level non-adjustable?

no

## ● Idle speed

(Switch dimmer light on.)  
Manual transmission and automatic transmission  
(selector lever in "Park"):

775 ... 925 min<sup>-1</sup>

## ● CO-setting

0.9 ... 1.6 vol. %CO

## Note:

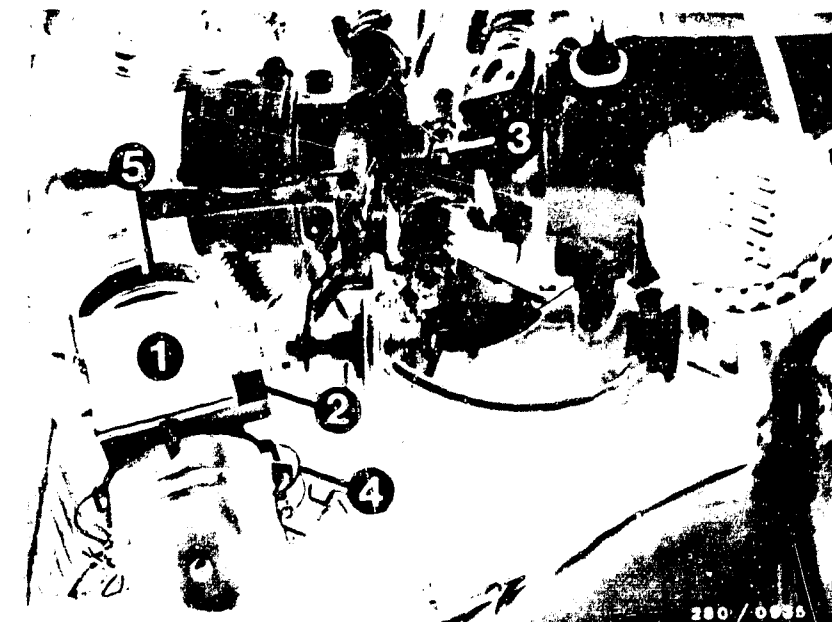
When testing or adjusting the idle and CO, make certain by disconnecting and sealing the vacuum control line (figure at bottom, arrow) on the recirculation valve that the exhaust-gas recirculation system is not operating.

When operating the vehicle in countries that do not have stringent exhaust-gas regulations, it is not necessary to render the system inoperative.

The combustion temperature is lowered by recirculation of the exhaust gas to the intake manifold, thus reducing the emission of nitrogen oxides.

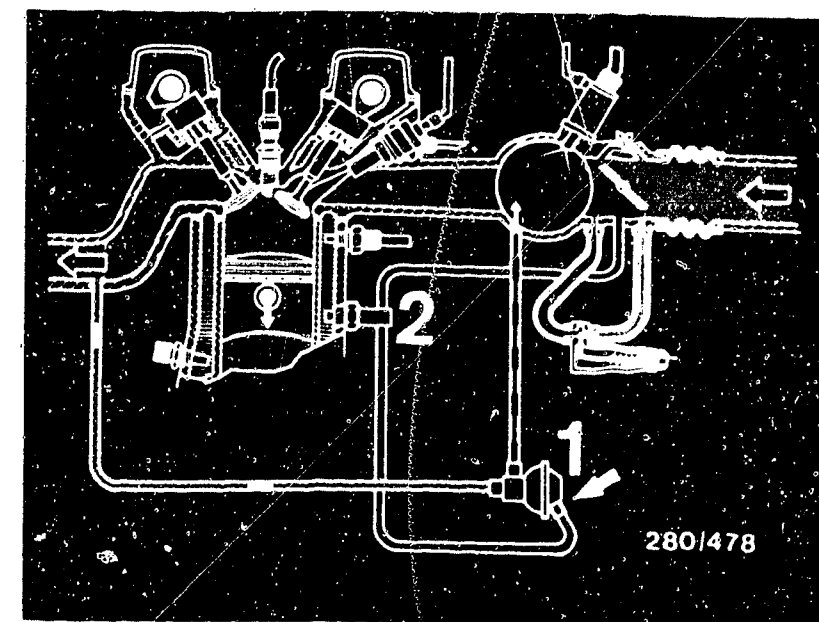
yes

Continued on H1/H2



2 = Potentiometer for idle CO-adjustment  
3 = Idle-speed-adjusting screw

1 = Recirculation valve  
2 = Thermostatic valve



**G23**

Rough idle  
Saab



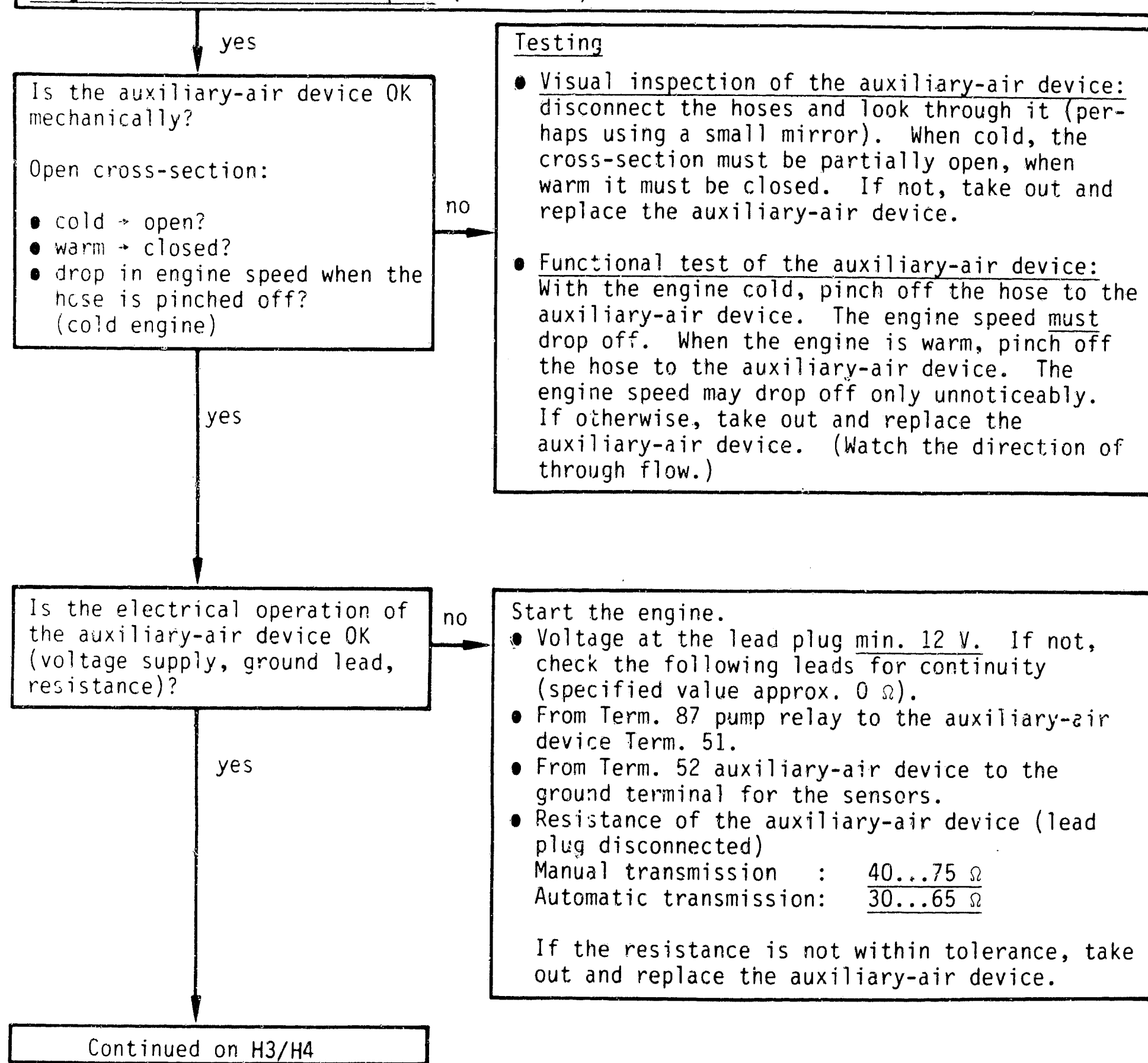
**G24**

Rough idle  
Saab





Rough idle, incorrect idle speed (continued)



Arrow = auxiliary-air device

H1

Rough idle  
Saab



H2

Rough idle  
Saab



### Rough idle, incorrect idle speed (continued)

yes

Has the operation of the solenoid-operated fuel-injection valves been checked?

- Has the pattern shown at the right been obtained?
- Are they free of deviations or missing or interference?

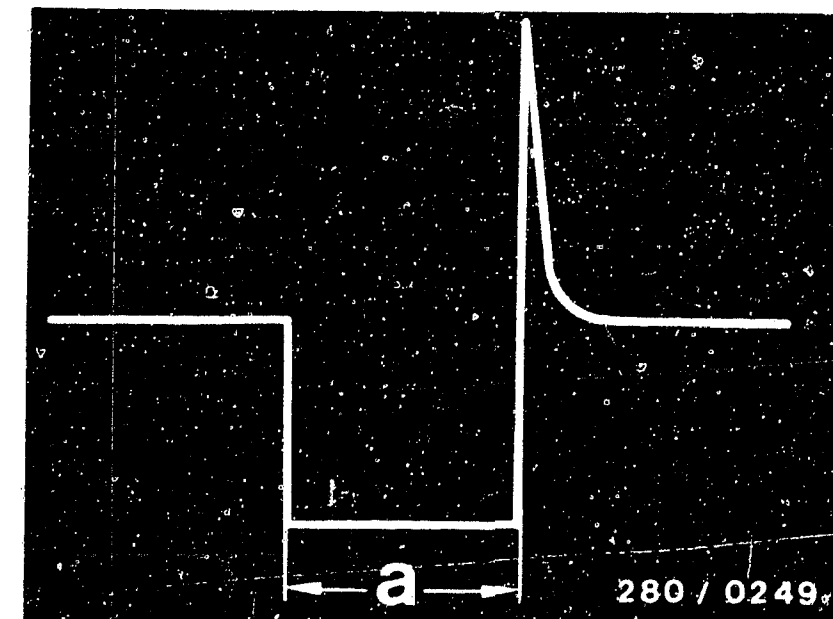
no

#### Checking the operation of the solenoid-operated fuel-injection valves:

- Connect the test lead as follows:  
The 2-pin plug connections of the test lead are put in between one solenoid-operated fuel-injection valve and its connecting lead. Of the two other connecting terminals on the test lead, only one connecting terminal need be connected to the special input on the motortester.
- Caution!  
The free connection terminal must not come into contact with the vehicle ground!
- When connected correctly, the pattern shown at the right appears on the oscilloscope. Using the test lead, it is possible to check the fuel-injection pulses on the solenoid-operated fuel-injection valves using an ignition oscilloscope. If the pattern shown at the right is not obtained or if deviations are seen (interference, missing, etc), the other solenoid-operated fuel-injection valves should also be examined.
- If there is interference: check how the leads are laid.
- If there is missing: eliminate loose contacts in the leads or in the plug connections.

yes

Continued on H5/H6



Fuel-injection pulses for a switched output stage (measured on the solenoid-operated fuel-injection valve)

a = pulse length (dependent on the engine load)

2 = Solenoid-operated fuel-injection valves



**H3**

Rough idle  
Saab



**H4**

Rough idle  
Saab



Eneven idle, incorrect idle speed (continued)

yes

Are solenoid-operated injection valves in good mechanical and hydraulic order?

no

● Mechanical and hydraulic test of solenoid-operated injection valves:  
Let engine run at operating temperature (+80°C). Disconnect and reconnect injection-valve plugs individually one after the other. Engine speed will  
1. remain almost constant if the injection valve is defective.  
2. Fall significantly if the injection valve is good.  
Wait until you get constant engine speeds.  
Replace any defective solenoid-operated injection valves.

yes

Are solenoid-operated injection valves in good electrical order?

no

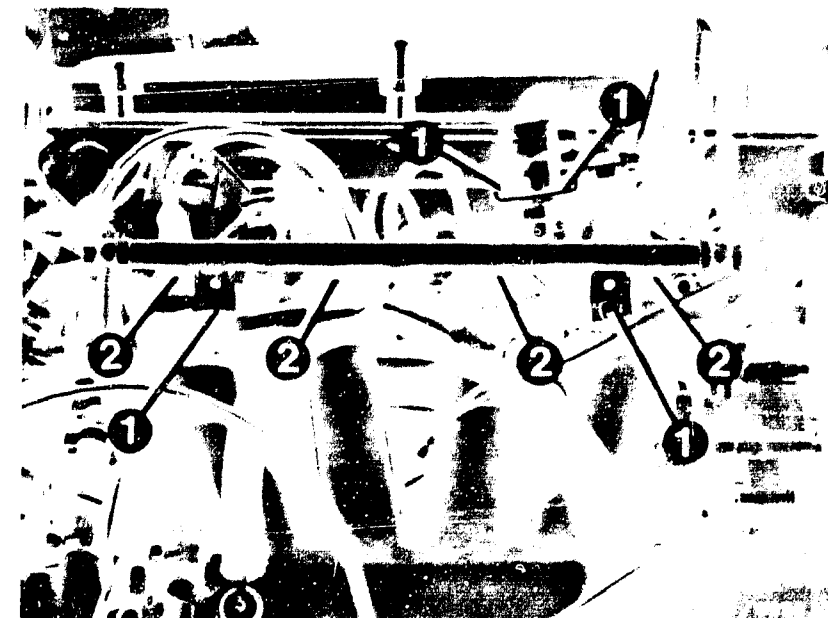
● Electrical test of solenoid-operated injection valves:  
Check connection leads from control relay term. 87 to the individual injection valves and from injection valves to control-unit plug term. 12 or term. 24 for continuity using ohmmeter:  
Nominal value: approx. 0  $\Omega$

Resistance of the individual solenoid-operated injection valves:

0 280 150 208/210: 15 ... 20  $\Omega$   
0 280 150 705/716: 14.5 ... 19.5  $\Omega$

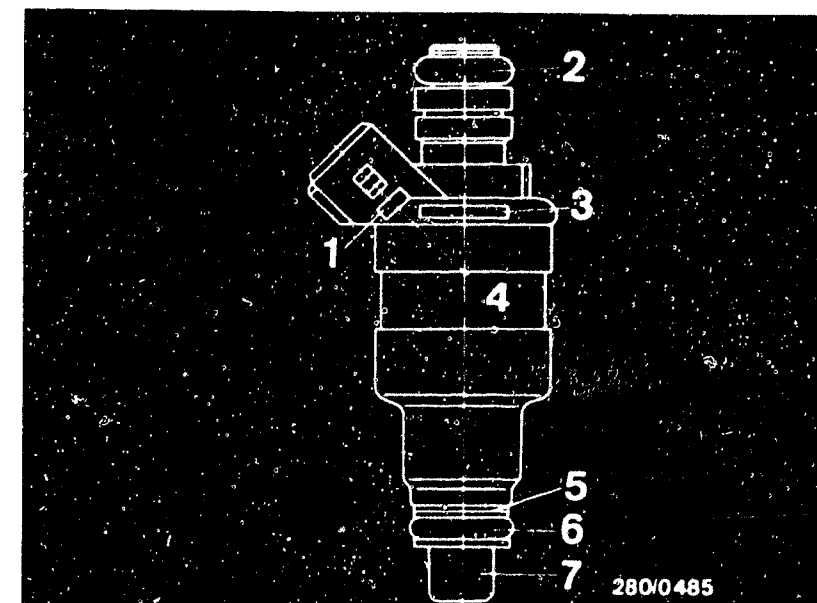
yes

Continued on H7/H8



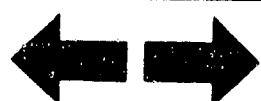
2 = Solenoid-operated injection valves

1 = Date of manufacture marking  
2 = Upper O-ring  
3 = Part number  
4 = Solenoid-operated injection valve  
5 = Supporting disk (yellow, 2 mm)  
6 = Lower O-ring  
7 = Protection sleeve



H5

Rough idle  
Saab



H6

Rough idle  
Saab



# Rough idle, incorrect idle speed (continued)

yes

Are the solenoid-operated fuel-injection valves OK?

no

● Removal and installation

yes

Continued on H9/H10

## ● Removal

Take out the fuel distribution pipe and the solenoid-operated fuel-injection valves.

- Release the fastenings screws on the fuel distribution pipe and the pressure regulator.
- Carefully pull all 4 solenoid-operated fuel-injection valves simultaneously out of the cylinder head.

Take out and replace the solenoid-operated fuel-injection valve.

- Disconnect the electrical connection.
- Carefully shove the retaining bracket out of the slot.
- Carefully pull the defective solenoid-operated fuel-injection valve out of the fuel distribution pipe.

Caution! Catch any fuel that runs out. Do not allow to drip on hot parts of the engine.

Caution! Before installation, the two O-rings may be greased only lightly (silicone grease Ft2v1). The other parts of the solenoid-operated fuel-injection valves must remain free of grease.

## ● Installation

- Carefully put the new solenoid-operated fuel-injection valve onto the fuel distribution pipe.
- Shove the retaining bracket into the slot until it latches. (Check the connection for leaks.)
- Put on the electrical connection (good contact).
- Carefully insert all 4 solenoid-operated fuel-injection valves into the intake manifold at the same time using the fuel distribution pipe.

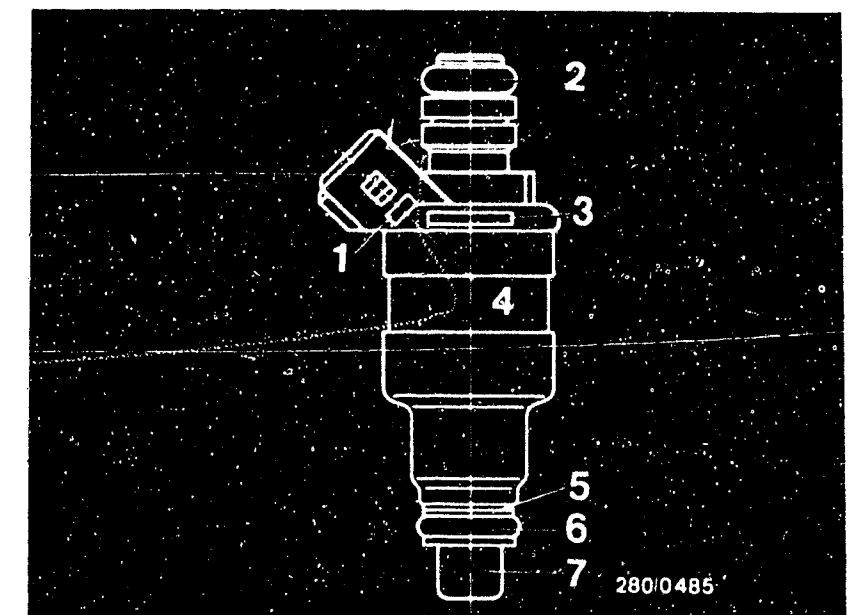
Caution! Do not damage any O-rings or solenoid-operated fuel-injection valve needles!

- Fasten the pressure regulator and the fuel distribution pipe with the screws (watch for leaks). After testing or installation, the original condition of installation must be restored. Check for leaks.



1 = Fastening screws  
2 = Solenoid-operated fuel-injection valves

1 = FD-marking  
2 = Top O-ring  
3 = Part No.  
4 = Solenoid-operated fuel-injection valve  
5 = Supporting plate  
6 = Bottom O-ring  
7 = Protective sleeve



H7

Rough idle  
Saab



H8

Rough idle  
Saab



Rough idle, incorrect idle speed (continued)

yes

Are all hose lines and electrical lead connections correctly put on?  
Visual inspection.  
Has the intake system been checked for leaks?

no

Check that the hoses for the air intake system and the fuel line system have been put on correctly, without kinking or damage. If need be, take out and replace hoses. Correct leaks by using new seals or by tightening the connecting screws.

Checking for leaks

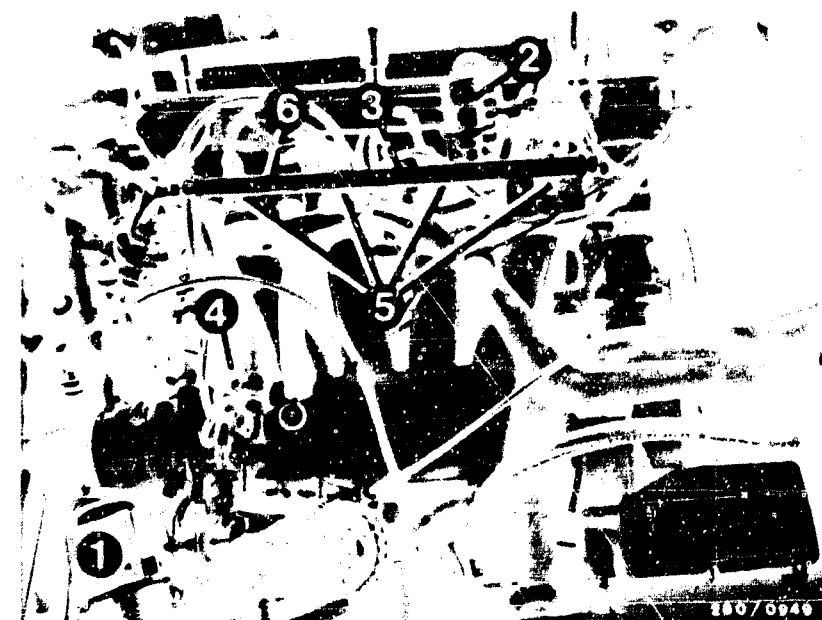
Seal off the exhaust pipe, unscrew the hose from the air filter to the air-mass sensor at the air-mass sensor and seal off the air-mass sensor channel (dust cover). Disconnect the hose after the auxiliary-air device. Seal off the auxiliary-air device connection. Using a compressed air gun (0.3 bar), blow into the hose to the intake manifold. In so doing, open the throttle valve all the way. Using soapy water, brush or spray all connections. Bubbling or foaming indicates leaks.

Caution!

Put all hoses back on and tighten hose clamps securely. Check for leaks.

yes

Continued on H11/H12



- 1 = Hot-wire air-mass sensor
- 2 = Pressure regulator
- 3 = Temperature sensor 11 (engine)
- 4 = Throttle-valve switch
- 5 = Solenoid-operated fuel-injection valve
- 6 = Ground terminal

**H9**

Rough idle  
Saab



**H10**

Rough idle  
Saab



Rough idle, incorrect idle speed (continued)

yes

Have the CO and idle been set correctly?  
(Repetition)

no

### CO and idle adjustment

Exhaust-gas adjustment using the exhaust-gas measuring device with the engine at normal operating temperature and at idle speed.

- When connecting to the exhaust-gas evacuation system when running the engine in the workshop, make certain that no excessively great vacuum occurs in the evacuation system because that could, among other things, affect the result of the measurement of CO levels. For the connection to the exhaust-gas evacuation system, see the Figure at the top.

If turbo vehicles are connected to excessively high pressure, that can cause oil to be pulled through at the turbocharger seals.

This drenches the steel wool in the exhaust system with oil, which causes blue smoke at the exhaust pipe even after fairly long periods of driving.

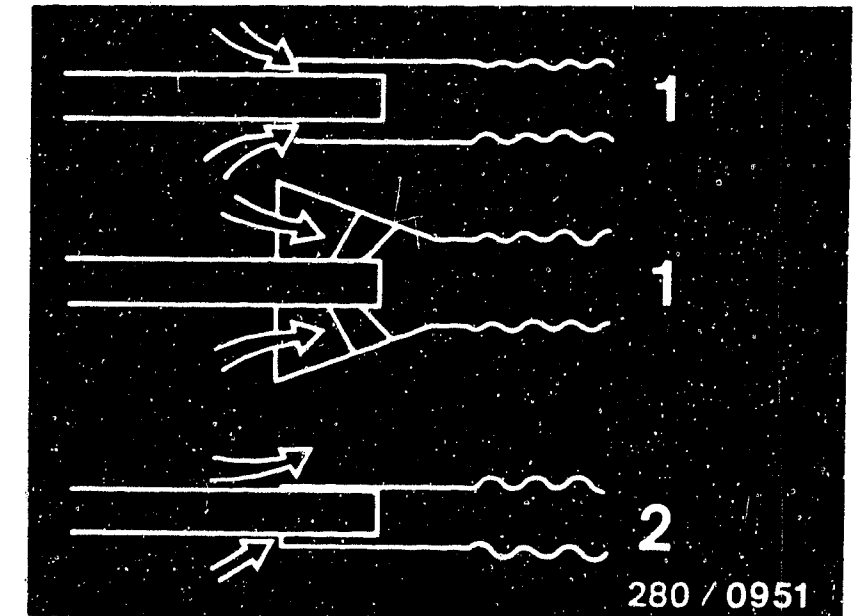
An excessive vacuum in the exhaust-gas evacuation system can be avoided by using exhaust-gas hoses with an open connection.

- An exhaust-gas recirculation, "EGR," has been installed in this vehicle due to certain exhaust-gas regulations.

yes

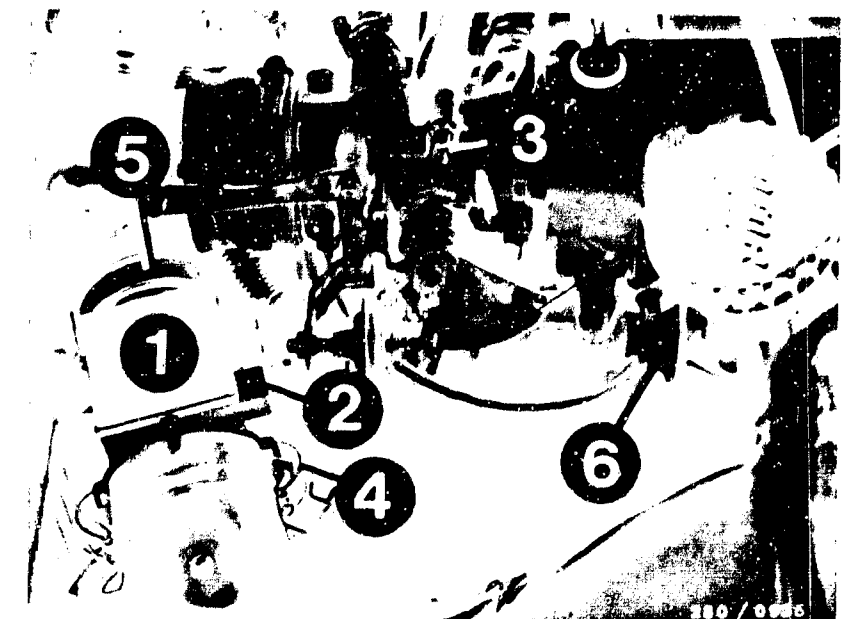
Continued on H13/H14

Continued on H13/H14



1 = correct  
2 = incorrect

6 = (Exhaust-gas) recirculation valve



**H11**

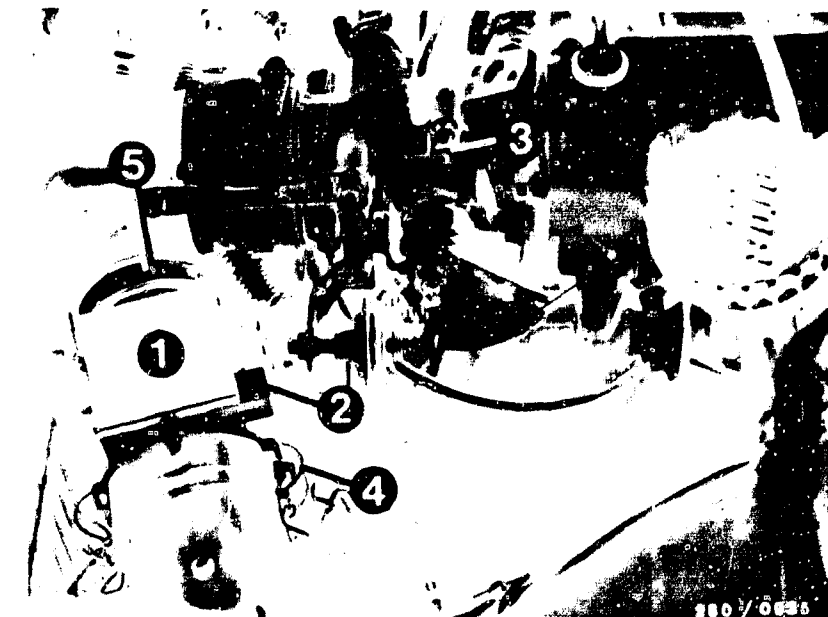
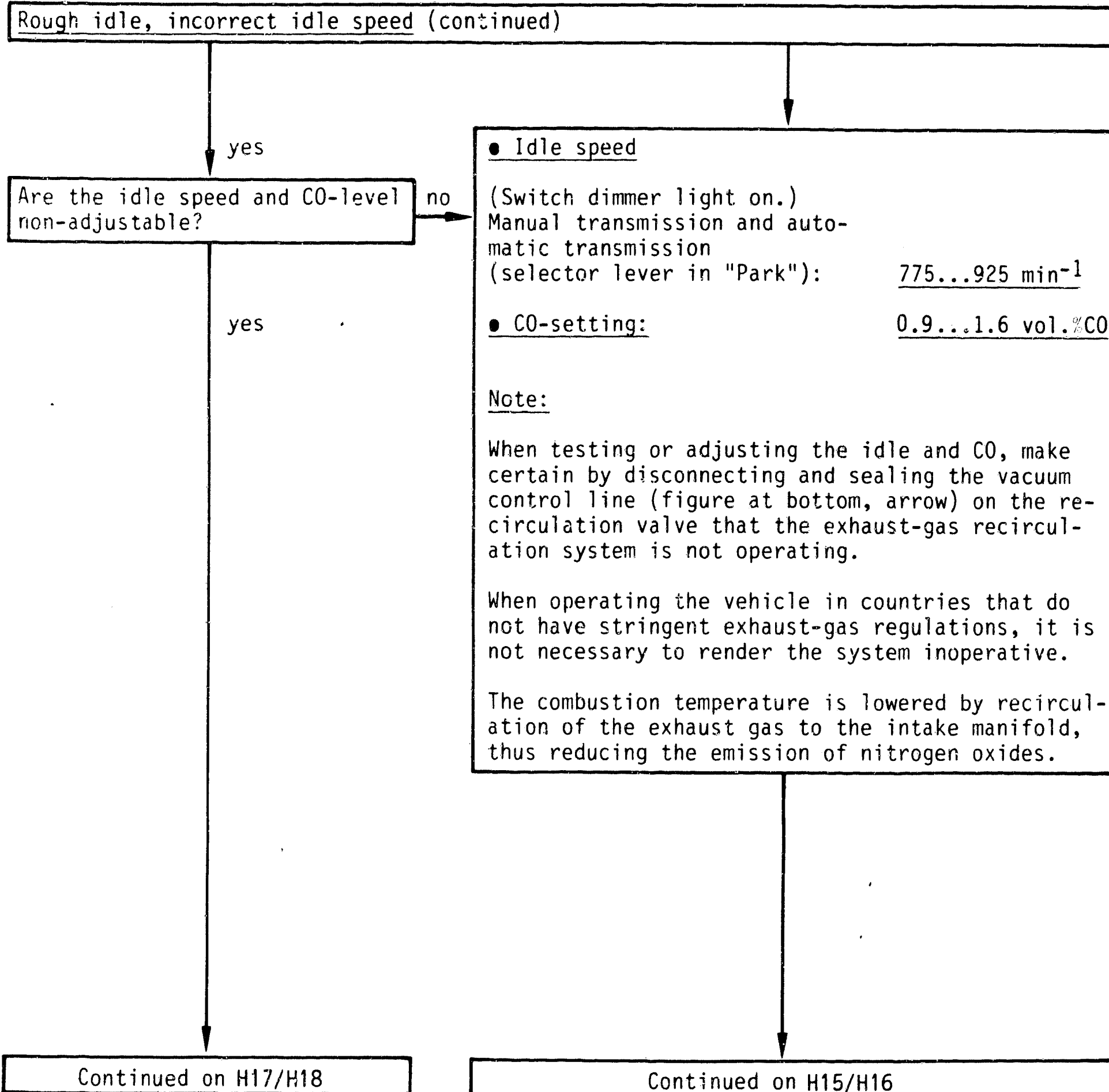
Rough idle  
Saab



**H12**

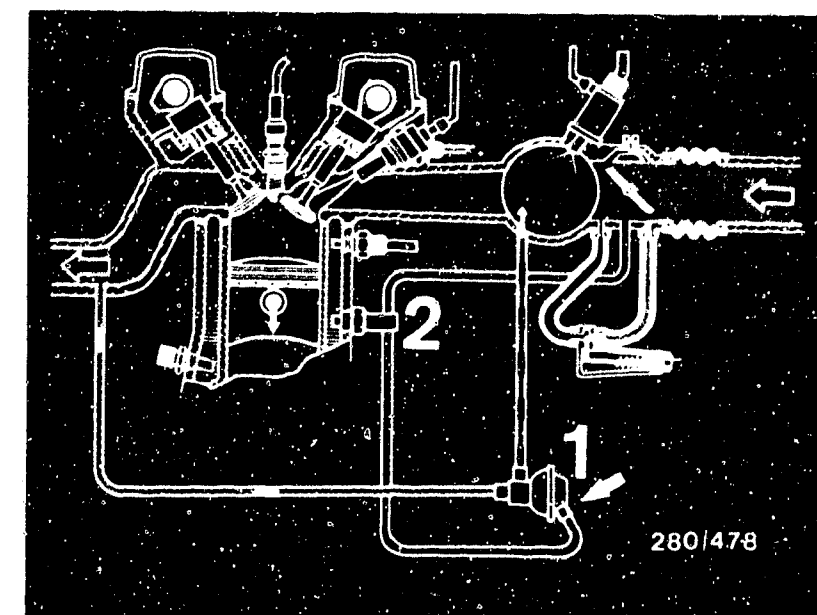
Rough idle  
Saab





2 = Potentiometer for idle CO-adjustment  
3 = Idle-speed-adjusting screw

1 = Recirculation valve  
2 = Thermostatic valve



H13

Rough idle  
Saab



H14

Rough idle  
Saab





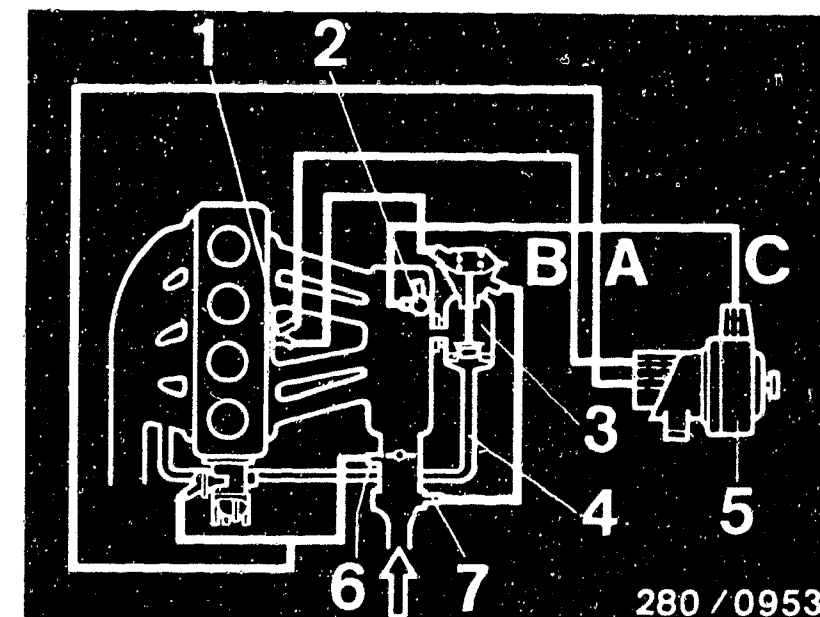
# Rough idle, incorrect idle speed (continued)

yes

The system operates depending on engine temperature and intake manifold pressure. It is operative only with an engine temperature of more than approx. 20°C and only in part-load operation or at low load.

- Checking the operation of the exhaust-gas recirculation system:
  - Have the engine at normal operating temperature, and run it at idle speed.
  - Disconnect the hose to the signal converter connection A at the branch point behind the throttle-valve housing (ignition timing adjustment hose).
  - Disconnect the hose at the signal converter connection C. Close off the hose using a finger or some other method so that no additional air is drawn into the intake manifold.
  - Using a vacuum pump, or by sucking, create a vacuum in the hose A which has been released previously. If the system is functioning properly, the idle speed must drop off, and the engine may stop.
  - Reconnect the hose to the signal converter connection C.
  - With hose A, which was previously taken off, produce a vacuum once again. If the system is functioning properly, the idle speed of the engine must remain unaffected.
- Checking the thermostatic valve:
  - To check operation of the thermostatic valve, release the hoses and blow through the valve.
  - The thermostatic valve is screwed into the intake manifold flange toward the cylinder head.
  - If the engine temperature is less than 20°C, the valve must be closed.
  - At engine temperatures above 20°C, the valve must have an open passage.

Continued on H17/H18



- 1 = Thermostatic valve
- 2 = Vacuum connection from the intake manifold
- 3 = Exhaust-gas recirculation valve
- 4 = Exhaust-gas recirculation pipe
- 5 = Signal converter
- 6 = Vacuum connection on the throttle valve (shared with ignition timing adjustment)
- 7 = Vacuum connection in front of the throttle valve

## Identification of the hose connections

- A = to the throttle-valve housing (ignition timing adjustment)
- B = via the thermostatic valve to the exhaust-gas recirculation valve (spring end)
- C = to the intake manifold (at the brake servo assist unit connection)

H 15

Rough idle  
Saab



H 16

Rough idle  
Saab





Rough idle, incorrect idle speed (continued)

yes

Checking the customer complaint

"Rough idle, incorrect idle speed,"

has been completed.

Has the customer complaint been corrected?

no

Other possible defects:

- The customer complaint has been incorrectly identified. (see Coordinates C3...C8.)  
If the defect has not been identified using the "targeted trouble-shooting," see "detailed trouble-shooting" (Coordinates C3/C4).
- Engine not OK mechanically (compression, valve setting, valve timing, wear on camshaft).

**H17**

Rough idle  
Saab



**H18**

Rough idle  
Saab



## POOR THROTTLE TAKE-UP

Trouble-shooting program according to customer complaint

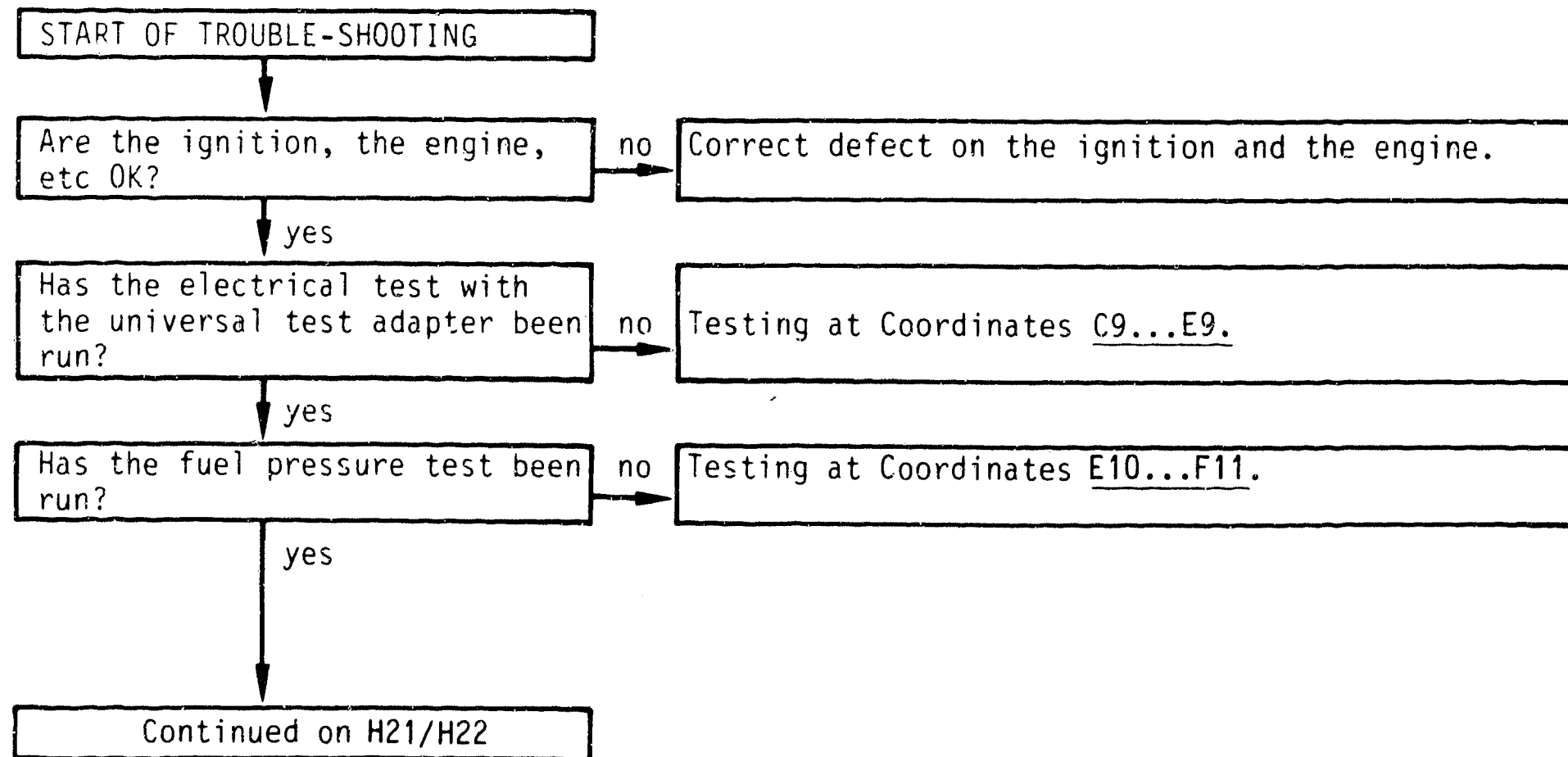
How to use the trouble-shooting program

Testing has been organized into 3 columns of boxes:

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**H19**

Poor throttle take-up  
Saab



**H20**

Poor throttle take-up  
Saab



## Poor throttle take-up (continued)

yes

Is the throttle valve closed?

- Does the throttle-valve lever strike against the stop screw?

no

### • Testing

Find out whether it is possible to close the throttle valve even further, causing the engine speed to drop off.

### • Throttle-valve adjustment:

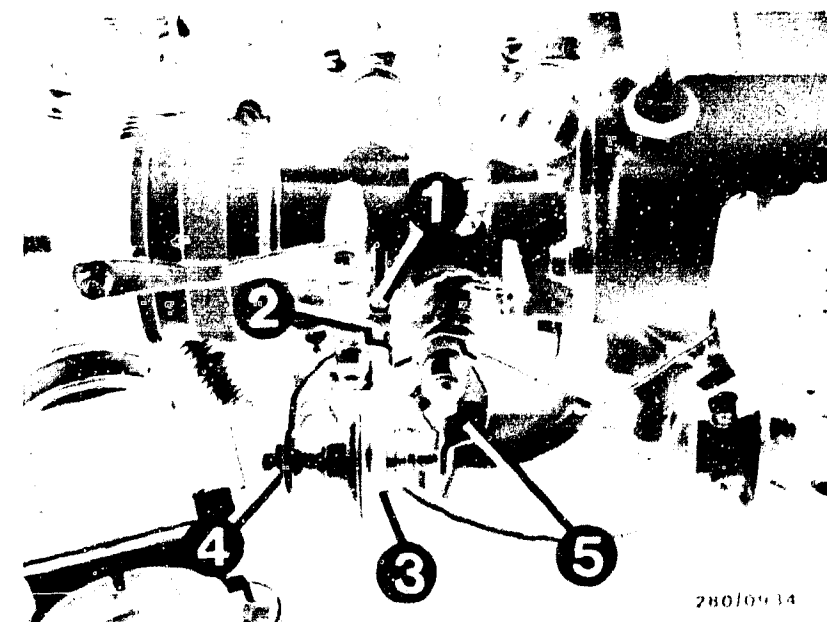
- Check whether the throttle valve is centered in the throttle-valve housing.
- Screw out the stop screw until there is no contact between the stop screw and the throttle-valve lever.
- Screw the stop screw in until the stop screw touches the throttle-valve lever.
- Then turn the stop screw 1/3 turn further in and secure the stop screw with a locking nut. This produces a clearance between the throttle valve and the throttle-valve housing of approx. 0.05 mm.

### • Check the length of the accelerator cable:

- The accelerator cable length must be at least long enough so that the throttle valve is in the idle setting.
- No play in the accelerator cable.
- The throttle valve must be fully open when the accelerator pedal is to the floor.

yes

Continued on H23/H24



- 1 = Throttle-valve stop screw
- 2 = Throttle-valve stop
- 3 = Throttle-valve damper
- 4 = Locking nut, for adjusting the throttle-valve damper
- 5 = Throttle-valve lever

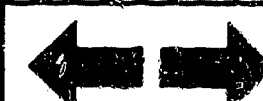
H21

Poor throttle take-up  
Saab



H22

Poor throttle take-up  
Saab



## Poor throttle take-up (continued)

yes

Is the mechanical throttle-valve damper OK?

- Testing
- Adjustment

no

### ● Testing

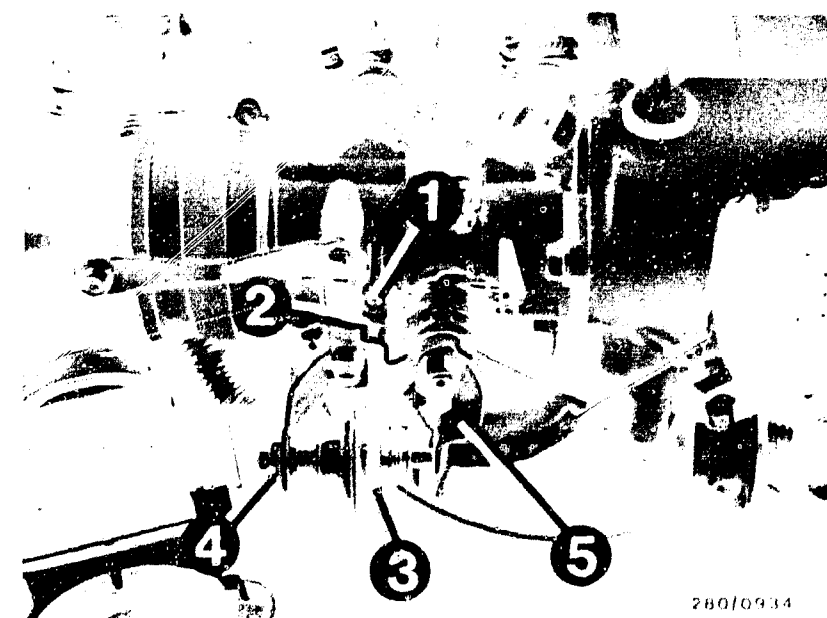
- With the engine at normal operating temperature, set an idle speed of  $775...925 \text{ min}^{-1}$ .
- Increase the engine's speed to  $2000 \text{ min}^{-1}$ , and using a stopwatch, measure the time between releasing the accelerator pedal and reaching idle speed. The delay time must be between  $3 \dots 6 \text{ secs.}$

### ● Adjustment

- Run the engine to normal operating temperature.
- Set the idle speed at  $775...925 \text{ min}^{-1}$  using the idle-speed adjusting screw.
- Release the locking nut on the throttle-valve damper.
- Increase engine speed to  $2000 \text{ min}^{-1}$ . Adjust the throttle-valve damper in such a way that it touches the throttle-valve lever. (Turning the throttle-valve damper toward the bracket = longer delay time. Turning the throttle-valve damper away from the bracket = shorter delay time.)
- Check the delay time. Increase the engine's speed to  $2000 \text{ min}^{-1}$ , and using a stopwatch, measure the time between releasing the accelerator pedal and reaching idle speed ( $775...925 \text{ min}^{-1}$ ). The delay time must be between  $3 \dots 6 \text{ secs.}$  Otherwise, take out and replace the throttle-valve damper.

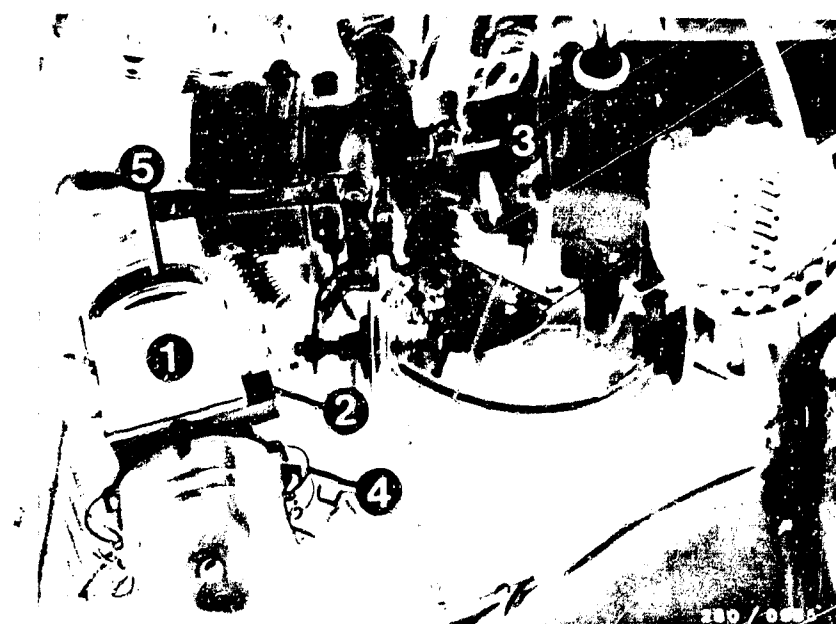
yes

Continued on J1/J2



- 3 = Throttle-valve damper
- 4 = Locking nut (for adjustment of the throttle-valve damper)
- 5 = Throttle-valve lever

3 = Idle-speed adjusting screw



**H23**

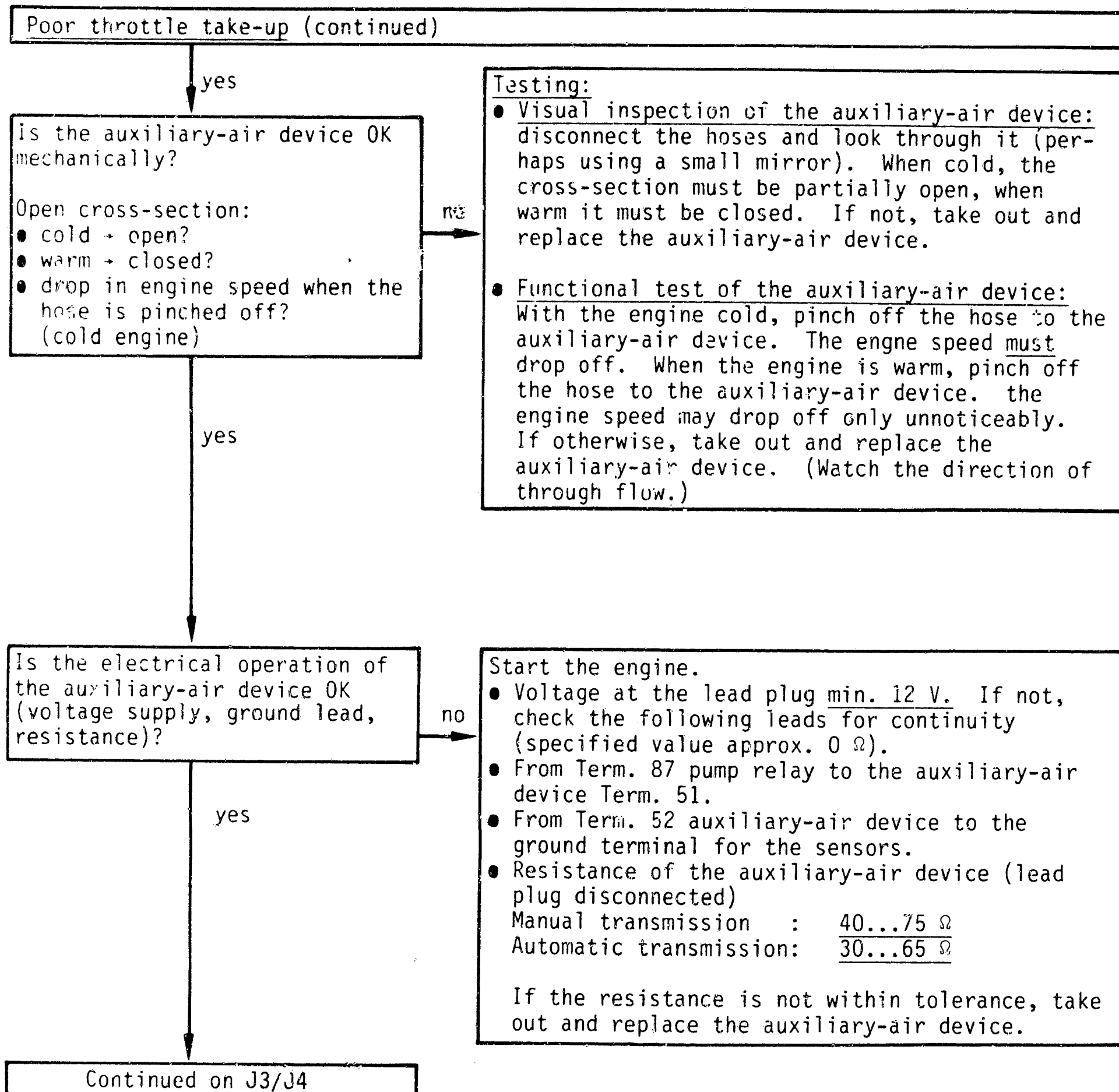
Poor throttle take-up  
Saab



**H24**

Poor throttle take-up  
Saab





Arrow = auxiliary-air device

# Poor throttle take-up (continued)

yes

Is the hot-wire air-mass sensor OK mechanically and electrically?

- Hot wire unbroken?
- Resistances within tolerance?

Between Term. 6 and Term. 3:

0...1100  $\Omega$

Between Term. 5 and Term. 3:

3.6...4.1  $\Omega$

no

## Removal

- Release both clamps on the air filter
- Release the hose clamp on the other side of the hot-wire air-mass sensor. Take out the hot-wire air-mass sensor.

## Testing

### • Visual inspection

- Is the connection plug put on correctly, the spring clamp snapped in, the plug free of twisting, with no plug prongs shoved back or poor contact. Watch for correct seating of the seal in the connecting plug.
- The wire screen OK on both sides?
- Is the hot wire broken? If yes, take out and replace the hot-wire air-sensor.

### • Electrical test

- Disconnect connection plug. Set multimeter or motortester at  $\Omega$ -range.

## Measurement of resistance

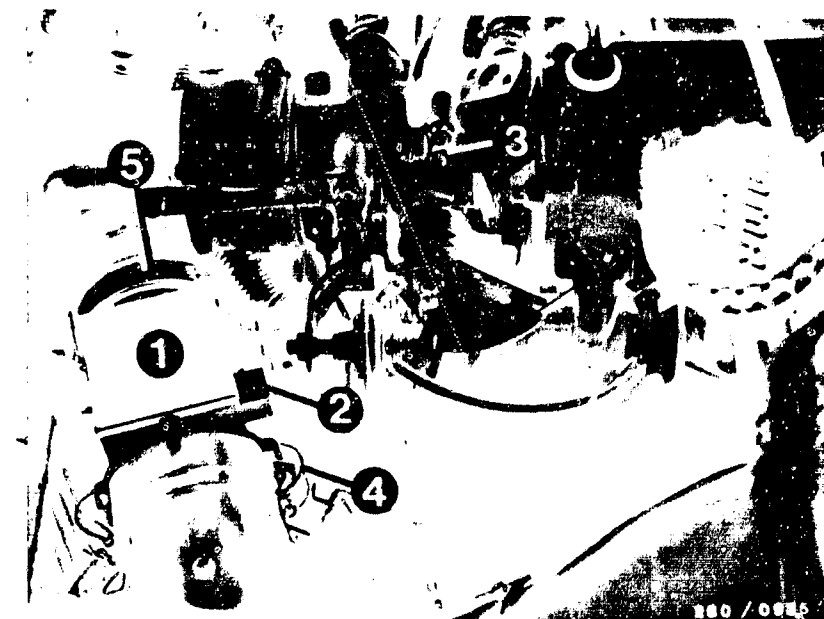
between Term. 6 and Term. 3: 0...1100  $\Omega$

between Term. 5 and Term. 3: 3.6...4.1  $\Omega$

If there are deviations, take out and replace the hot-wire air-mass sensor.

## Installation

- Connection plug put on correctly (good contact).
- Fasten the clamps.
- Put on the hoses, and tighten the hose clamps on the hot-wire air-mass sensor. (Watch for tight seals at the connections - unmetered air)



- 1 = Hot-wire air-mass sensor
- 2 = Potentiometer for idle-mixture adjustment
- 4 = Clamps
- 5 = Hose clamps

yes

Continued on J5/J6

J3

Poor throttle take-up  
Saab



J4

Poor throttle take-up  
Saab



Poor throttle take-up (continued)

yes

Are all hose lines and electrical lead connections correctly put on?  
Visual inspection.  
Has the intake system been checked for leaks?

no

Check that the hoses for the air intake system and the fuel line system have been put on correctly, without kinking or damage. If need be, take out and replace hoses. Correct leaks by using new seals or be tightening the connecting screws.

Checking for leaks

Seal off the exhaust pipe, unscrew the hose from the air filter to the air-mass sensor at the air-mass sensor and seal off the air-mass sensor channel (dust cover). Disconnect the hose after the auxiliary-air device. Seal off the auxiliary-air device connection. Using a compressed air gun (0.3 bar), blow into the hose to the intake manifold. In so doing, open the throttle valve all the way. Using soapy water, brush or spray all connections. Bubbling or foaming indicates leaks.

Caution!

Put all hoses back on and tighten hose clamps securely. Check for leaks.

yes

Continued on J7/J8



- 1 = Hot-wire air-mass sensor
- 2 = Pressure regulator
- 3 = Temperature sensor II (engine)
- 4 = Throttle-valve switch
- 5 = Solenoid-operated fuel-injection valve
- 6 = Ground terminal

J5

Poor throttle take-up  
Saab



J6

Poor throttle take-up  
Saab



# Poor throttle take-up (continued)

yes

Have the CO and idle been set correctly?

no

## CO and idle adjustment

Exhaust-gas adjustment using the exhaust-gas measuring device with the engine at normal operating temperature and at idle speed.

- When connecting to the exhaust-gas evacuation system when running the engine in the workshop, make certain that no excessively great vacuum occurs in the evacuation system because that could, among other things, affect the result of the measurement of CO levels. For the connection to the exhaust-gas evacuation system, see the Figure at the top.

If turbo vehicles are connected to excessively high pressure, that can cause oil to be pulled through at the turbocharger seals.

This drenches the steel wool in the exhaust system with oil, which causes blue smoke at the exhaust pipe even after fairly long period of driving.

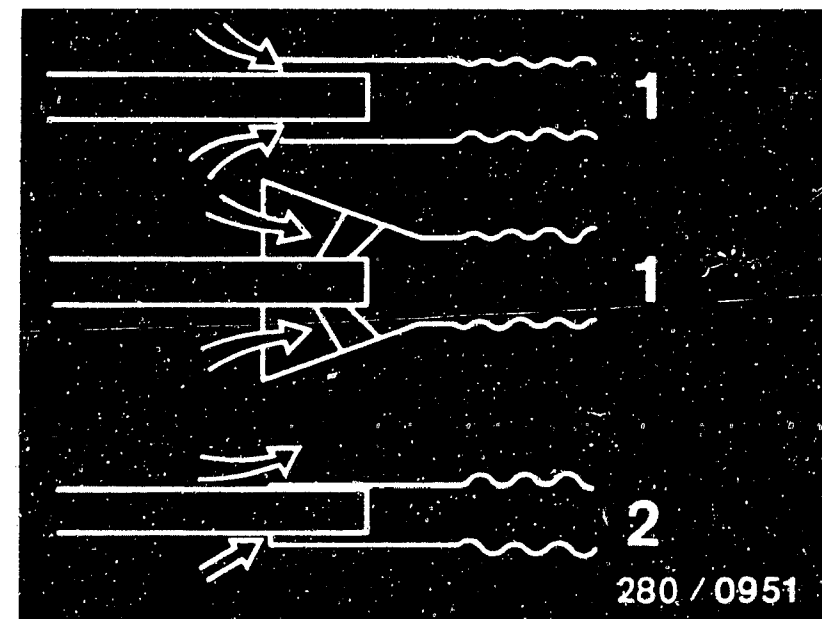
An excessive vacuum in the exhaust-gas evacuation system can be avoided by using exhaust-gas hoses with an open connection.

- An exhaust-gas recirculation, "EGR," has been installed in this vehicle due to certain exhaust-gas regulations.

yes

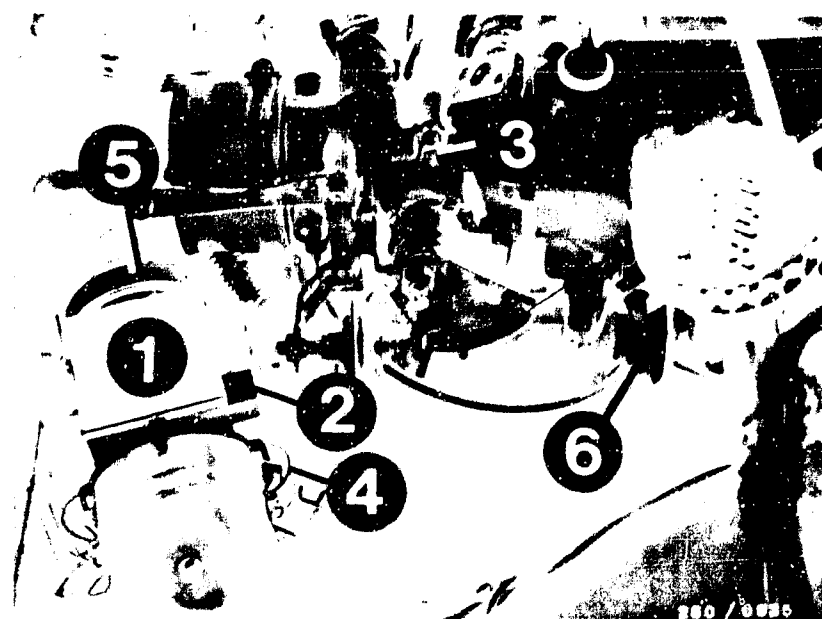
Continued on J9/J10

Continued on J9/J10



1 = correct  
2 = incorrect

6 = (Exhaust-gas) recirculation valve



J7

Poor throttle take-up  
Saab



J8

Poor throttle take-up  
Saab





# Poor throttle take-up (continued)

yes

Are the idle speed and CO-level non-adjustable?

no

- Idle speed  
(Switch dimmer light on.)

Manual transmission and automatic transmission  
(selector lever in "Park"):

775 ... 925 min<sup>-1</sup>

- CO-setting 0.9 ... 1.6 vol. %CO

## Note:

When testing or adjusting the idle and CO, make certain by disconnecting and sealing the vacuum control line (figure at bottom, arrow) on the recirculation valve that the exhaust-gas recirculation system is not operating.

When operating the vehicle in countries that do not have stringent exhaust-gas regulations, it is not necessary to render the system inoperative. The combustion temperature is lowered by recirculation of the exhaust gas to the intake manifold, thus reducing the emission of nitrogen oxides.

yes

Checking the customer complaint

"Poor throttle take-up"

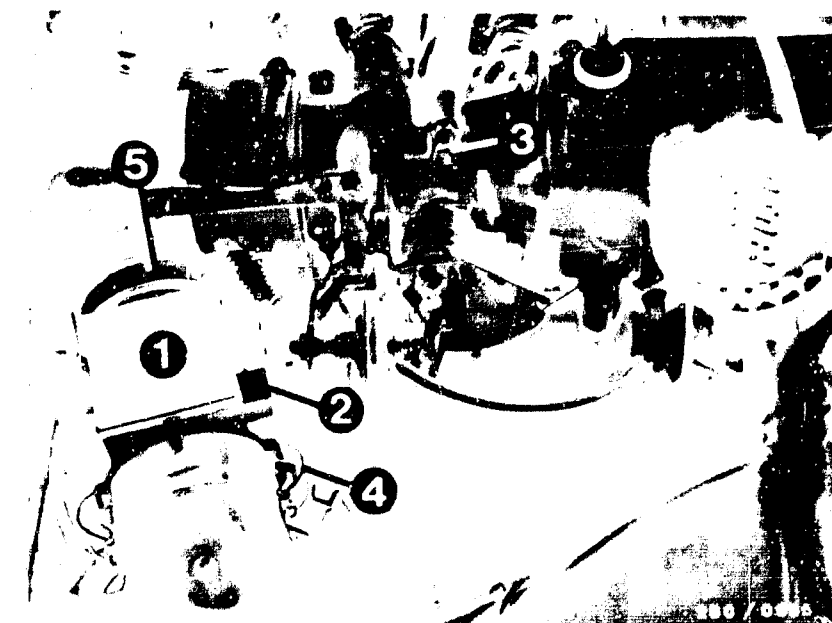
has been completed.

Has the customer complaint been corrected?

no

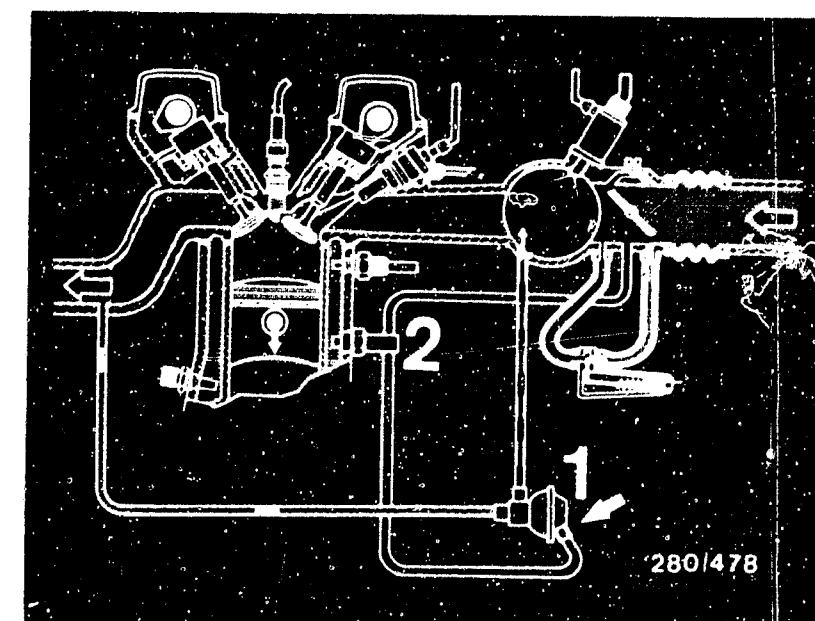
## Other possible defects

- The customer complaint has been incorrectly identified. (see Coordinates C3...C8.)  
If the defect has not been identified using the "targeted trouble-shooting," see the "detailed trouble-shooting."
- The engine is not OK mechanically.  
(Compression, valve setting, valve timing, wear on camshaft)



2 = Potentiometer for idle CO-adjustment  
3 = Idle-speed-adjusting screw

1 = Recirculation valve  
2 = Thermostatic valve



J9

Poor throttle take-up  
Saab



J10

Poor throttle take-up  
Saab



## ENGINE MISSING IN ALL DRIVING CONDITIONS

Trouble-shooting program according to customer complaint

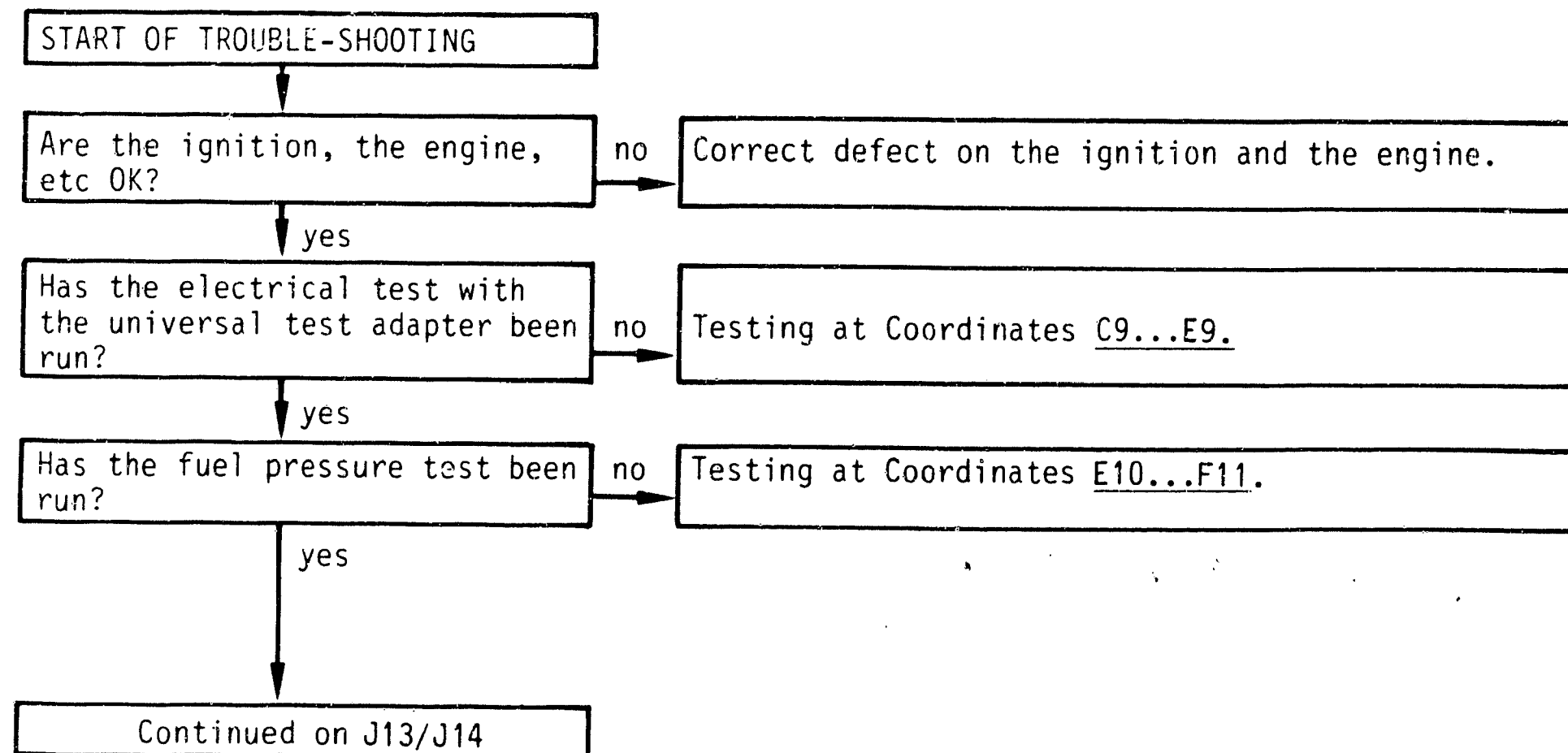
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**J11**

Engine missing in all driving conditions  
Saab



**J12**

Engine missing in all driving conditions  
Saab



Engine missing in all driving conditions (continued)

yes

Are the alternator and regulator OK?

- Is the engine free of missing caused by voltage peaks?

no

With the engine shut off, disconnect the plug from the alternator.

Start the engine.

If the missing has been eliminated, check the alternator and the regulator.

Voltage peaks can be seen on the ignition oscilloscope.

yes

Continued on J15/J16

**J13**

Engine missing in all driving conditions  
Saab



**J14**

Engine missing in all driving conditions  
Saab



Engine missing in all driving conditions (continued)

yes

Is the fuel delivery from the electric fuel pump OK?

Test specification:

min. 850 cm<sup>3</sup>/30 secs

no

● Measuring fuel delivery

To test, take apart the connection between the fuel return connection (on the pressure regulator) and the fuel return line (to the fuel tank).

- Connect a hose and direct it into a 5 l container with measuring scale.
- Disconnect the control unit plug on the LH-control unit.
- Make an auxiliary lead (lead Ø 1.5 mm, and blade terminals 6.3 mm at both ends).

Until 7.85:

- Disconnect 2-pin plug connection and connect auxiliary cable.

This plug connection is between the brake power assist unit and the coolant overflow reservoir.

As of 8.85:

Pull out pump fuse no. 30 and hazard-warning and turn-signal system no. 27 and bridge with auxiliary cable.

- Ignition "ON", in-tank electric fuel pump should operate.

Test specification: min. 850 cm<sup>3</sup>/30 secs

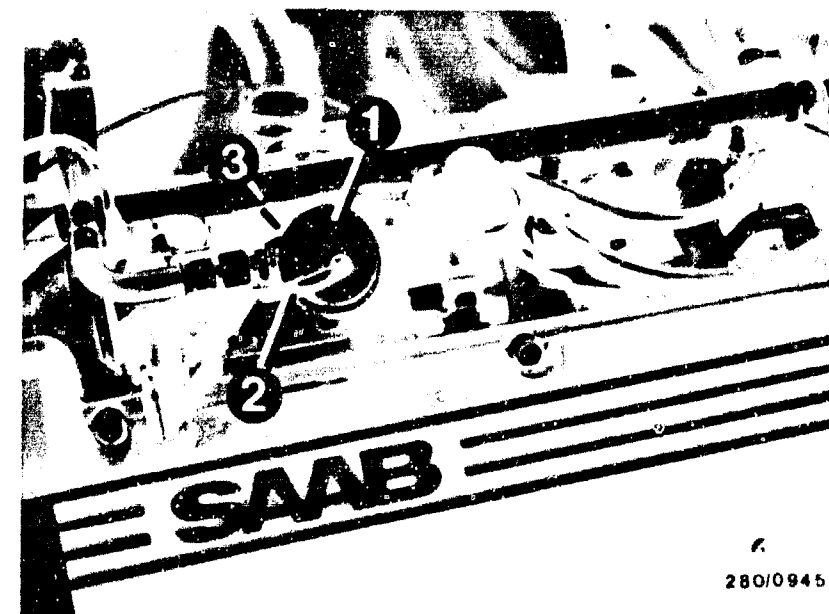
Caution!

After completion of the test, it is absolutely necessary to remove the auxiliary lead and restore the plug connection to the original condition.

yes

Continued on J17/J18

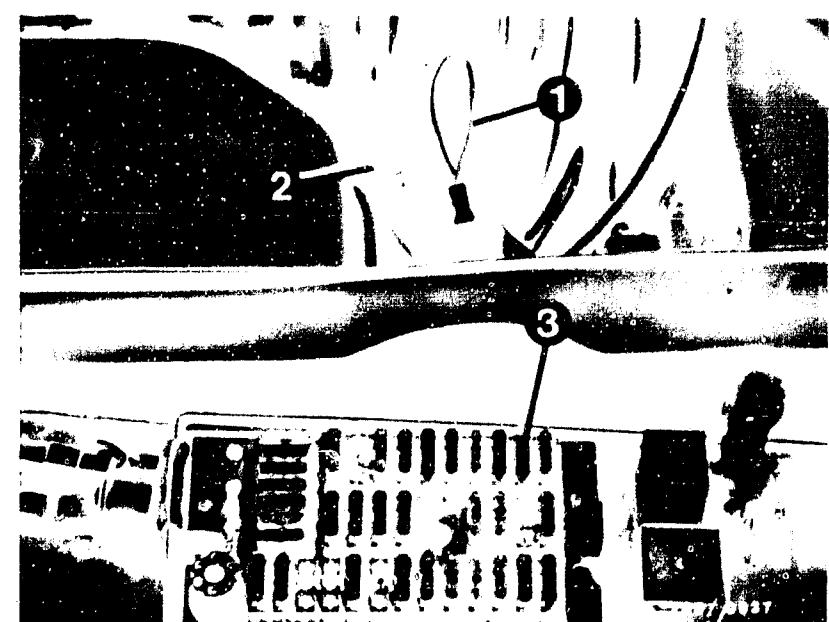
Continued on J17/J18



280/0945

- 1 = Pressure regulator  
2 = Intake manifold connection  
3 = Fuel return line

- 1 = Auxiliary lead  
2 = 2-pin plug connection  
3 = Pump fuse



J15

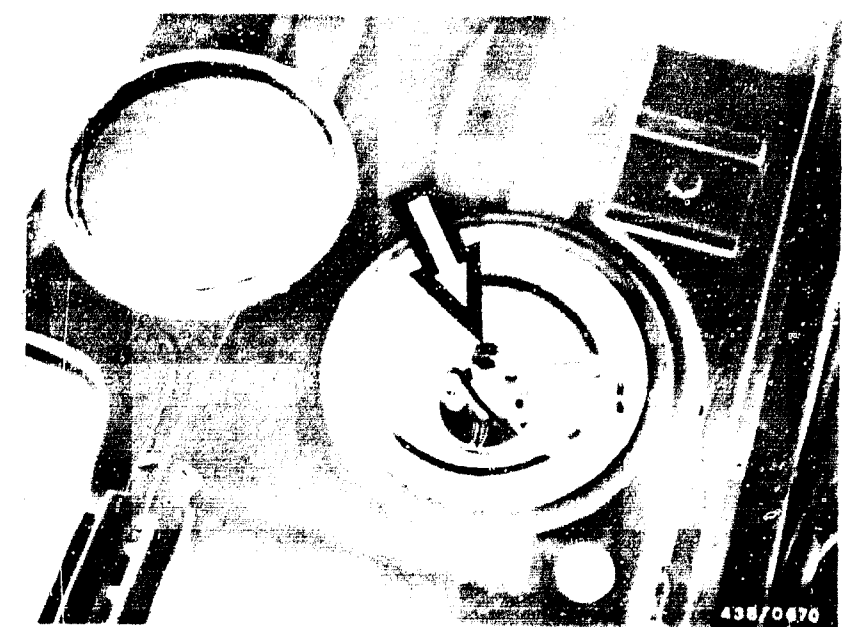
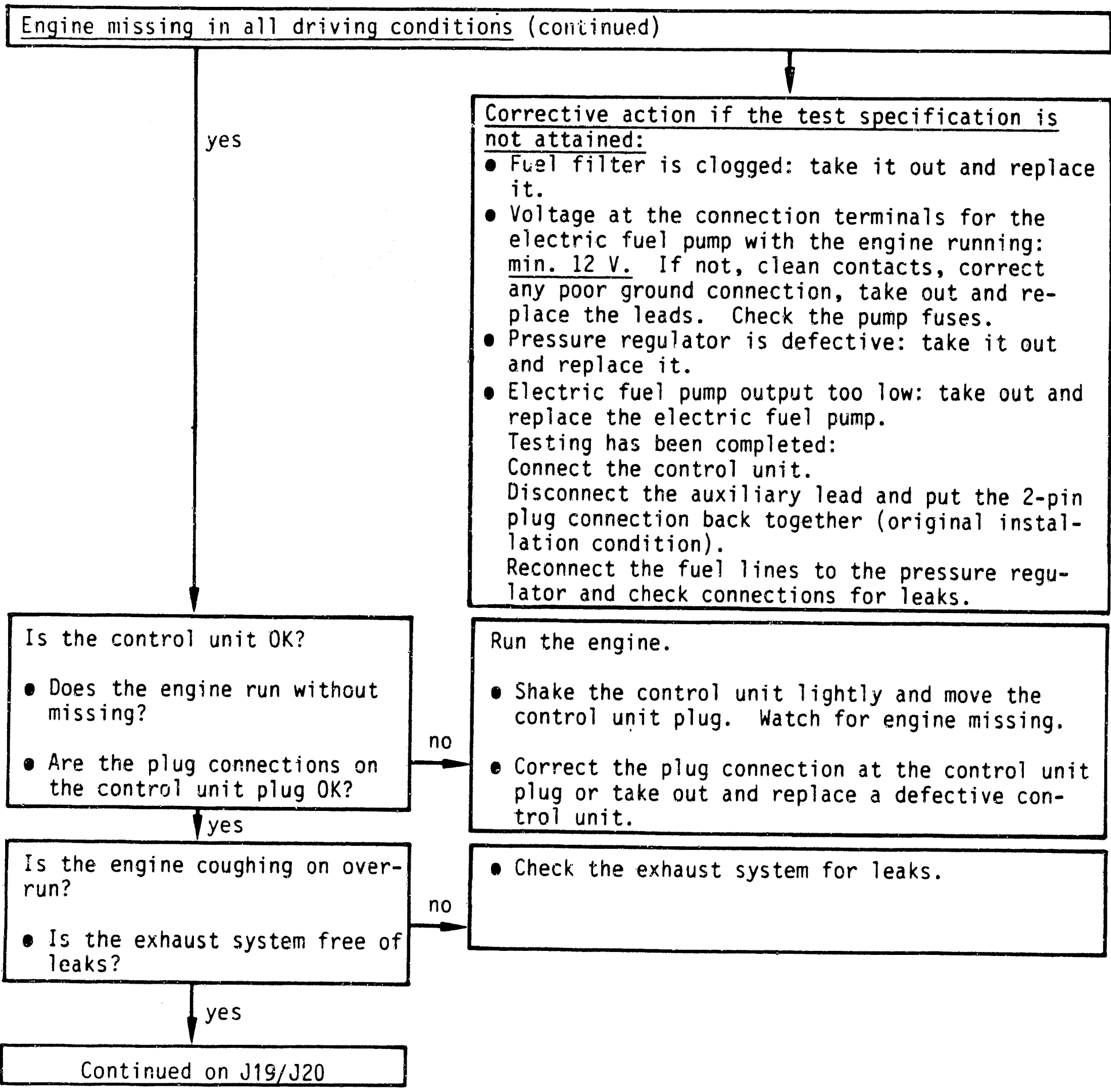
Engine missing in all driving conditions  
Saab



J16

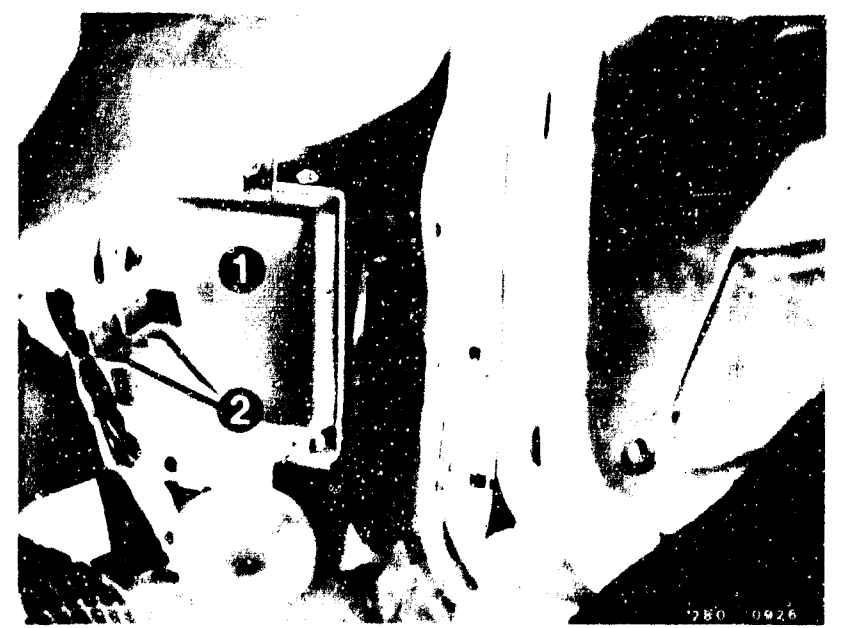
Engine missing in all driving conditions  
Saab





Arrow = In-tank electric fuel pump

1 = Control unit  
2 = Main and pump relays



Engine missing in all driving conditions (continued)

yes

Is there engine coughing on overrun?

Is the throttle valve closed?

- Does the throttle-valve lever strike against the stop screw?

no

• Testing

Find out whether it is possible to close the throttle valve even further, causing the engine speed to drop off.

• Throttle-valve adjustment:

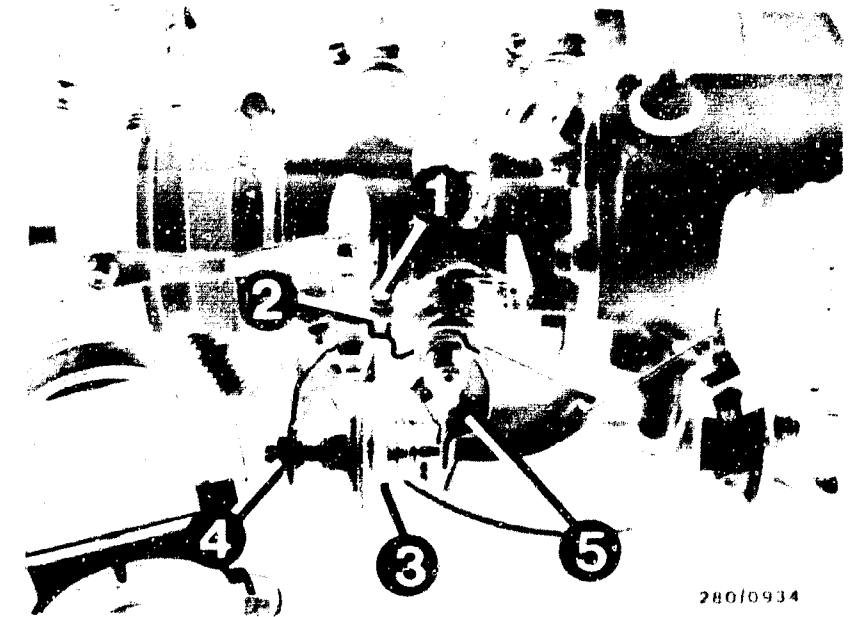
- Check whether the throttle valve is centered in the throttle-valve housing.
- Screw out the stop screw until there is no contact between the stop screw and the throttle-valve lever.
- Screw the stop screw in until the stop screw touches the throttle-valve lever.
- Then turn the stop screw 1/3 turn further in and secure the stop screw with a locking nut. This produces a clearance between the throttle valve and the throttle-valve housing of approx. 0.05 mm.

• Check the length of the accelerator cable:

- The accelerator cable length must be at least long enough so that the throttle valve is in the idle setting.
- No play in the accelerator cable.
- The throttle valve must be fully open when the accelerator pedal is to the floor.

yes

Continued on J21/J22



28010934

- 1 = Throttle-valve stop screw
- 2 = Throttle-valve stop
- 3 = Throttle-valve damper
- 4 = Locking nut, for adjusting the throttle-valve damper
- 5 = Throttle-valve lever

J19

Engine missing in all driving conditions  
Saab



J20

Engine missing in all driving conditions  
Saab



Engine missing in all driving conditions (continued)

yes

Is the mechanical throttle-valve damper OK?

- Testing
- Adjusting

no

• Testing

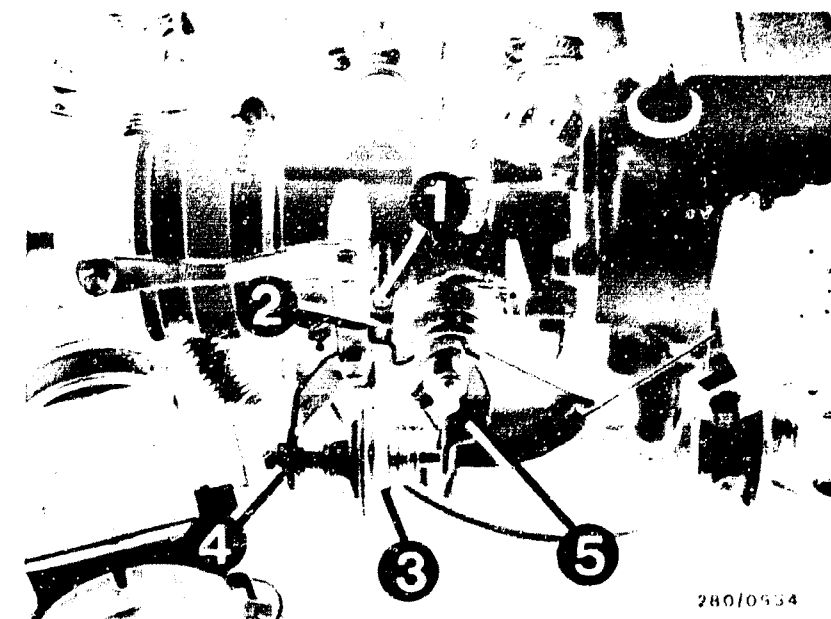
- With the engine at normal operating temperature, set an idle speed of  $775...925 \text{ min}^{-1}$ .
- Increase the engine's speed to  $2000 \text{ min}^{-1}$ , and using a stopwatch, measure the time between releasing the accelerator pedal and reaching idle speed. The delay time must be between 3 ... 6 secs.

• Adjustment

- Run the engine to normal operating temperature.
- Set the idle speed at  $775...925 \text{ min}^{-1}$  using the idle-speed adjusting screw.
- Release the locking nut on the throttle-valve damper.
- Increase engine speed to  $2000 \text{ min}^{-1}$ . Adjust the throttle-valve damper in such a way that it touches the throttle-valve lever. (Turning the throttle-valve damper toward the bracket = longer delay time. Turning the throttle-valve damper away from the bracket = shorter delay time.)
- Check the delay time. Increase the engine's speed to  $2000 \text{ min}^{-1}$ , and using a stopwatch, measure the time between releasing the accelerator pedal and reaching idle speed ( $775...925 \text{ min}^{-1}$ ). The delay time must be between 3 ... 6 secs. Otherwise, take out and replace the throttle-valve damper.

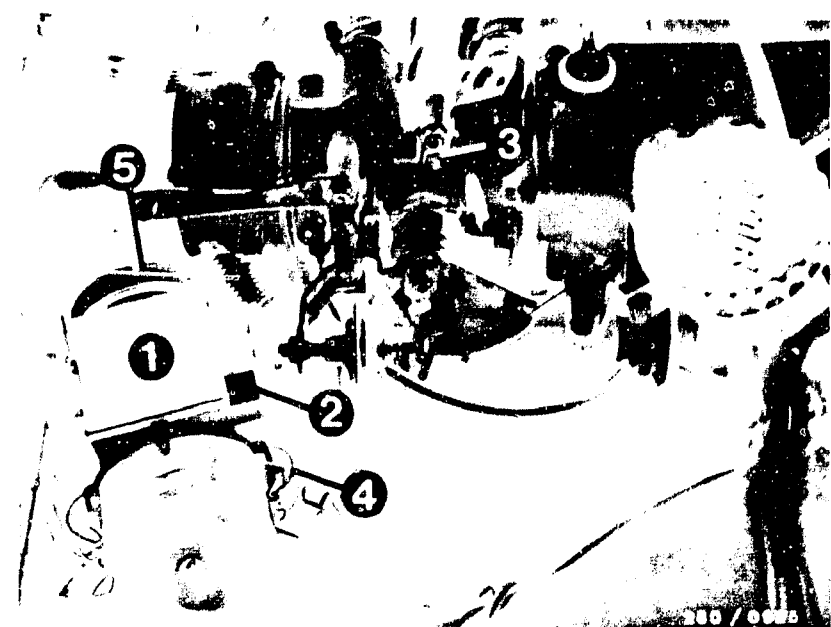
yes

Continued on J23/J24



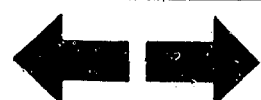
- 3 = Throttle-valve damper
- 4 = Locking nut (for adjustment of the throttle-valve damper)
- 5 = Throttle-valve lever

3 = Idle-speed adjusting screw



J21

Engine missing in all driving conditions  
Saab



J22

Engine missing in all driving conditions  
Saab





# Engine missing in all driving conditions (continued)

yes

Has the operation of the solenoid-operated fuel-injection valves been checked?

- Has the injection signal been checked for missing?
- Are the fuel injection pulses free of interference or missing?
- Have the leads been laid properly?
- Are the plug connections free of loose contacts?

no

- Connect the test lead as follows:  
The 2-pin plug connections of the test lead are put in between one solenoid-operated fuel-injection valve and its connecting lead. Of the two other connecting terminals on the test lead, only one connecting terminal need be connected to the special input on the motortester.
- When connected correctly, the pattern shown at the right appears on the oscilloscope. Using the test lead, it is possible to check the fuel-injection pulses on the solenoid-operated fuel-injection valves using an ignition oscilloscope. If the pattern shown at the right is not obtained or if deviations are seen (interference, missing, etc), the other solenoid-operated fuel-injection valves should also be examined.
- If there is interference: check how the leads are laid.
- If there is missing: eliminate loose contacts in the leads or in the plug connections.

yes

Is the solenoid-operated fuel-injection valve OK mechanically?

- Does the engine speed drop off when the fuel-injection valve connectors are pulled?

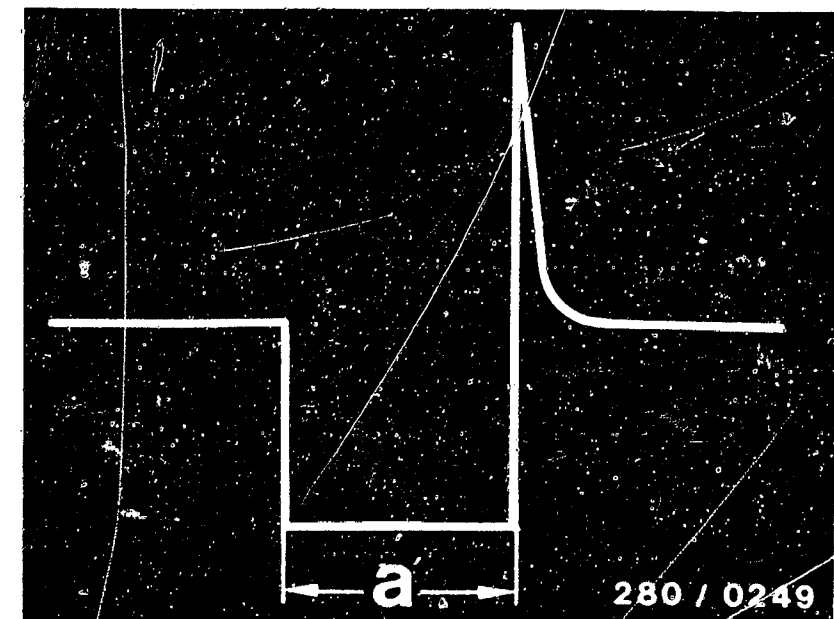
no

- Mechanical and hydraulic test of solenoid-operated injection valves:  
Run engine at operating temperature (+80°C). Disconnect and reconnect injection-valve plugs individually one after the other.

yes

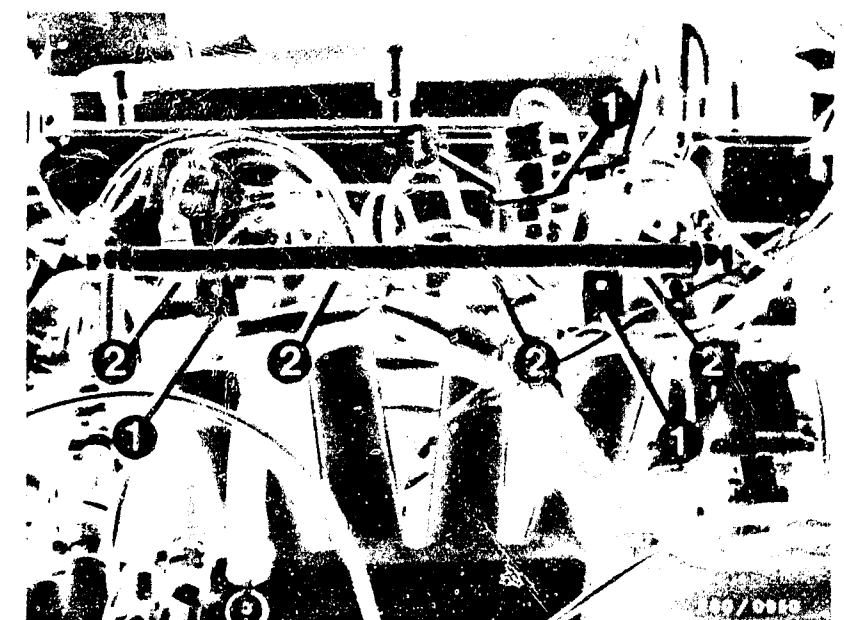
Continued on K1/K2

Continued on K1/K2



Fuel-injection pulses for a switched output stage (measured on the solenoid-operated fuel-injection valve)  
a = pulse length (dependent on the engine load)

2 = Solenoid-operated fuel-injection valves



**J23**

Engine missing in all driving conditions  
Saab



**J24**

Engine missing in all driving conditions  
Saab





Engine missing in all driving conditions (continued)

yes

Are the solenoid-operated fuel-injection valves OK?

- Removal and installation
- Is the O-ring OK?

no

Engine speed will

1. remain almost constant if solenoid-operated injection valve is defective.
2. fall significantly if injection valve is good. Wait until you get constant engine speeds. Replace any defective solenoid-operated injection valves.

• Removal

Take out the fuel distribution pipe and the solenoid-operated fuel-injection valves.

- Release the fastenings screws on the fuel distribution pipe but not the pressure regulator.
- Carefully pull all 4 solenoid-operated fuel-injection valves simultaneously out of the cylinder head.

Take out and replace the solenoid-operated fuel-injection valve.

- Disconnect the electrical connection.
- Carefully shove the retaining bracket out of the slot.
- Carefully pull the defective solenoid-operated fuel-injection valve out of the fuel distribution pipe.

Caution! Catch any fuel that runs out. Do not allow to drip on hot parts of the engine.

If the O-ring is defective and/or swollen

Cut the bottom O-ring (intake tube) into pieces. Caution! Do not damage the protective sleeve. Pull a new O-ring over the protective sleeve and its shoulder. Do not damage any parts in so doing. Use parts kit 1 287 010 704. When working on the solenoid-operated fuel-injection valves, do not damage the valve needles.

yes

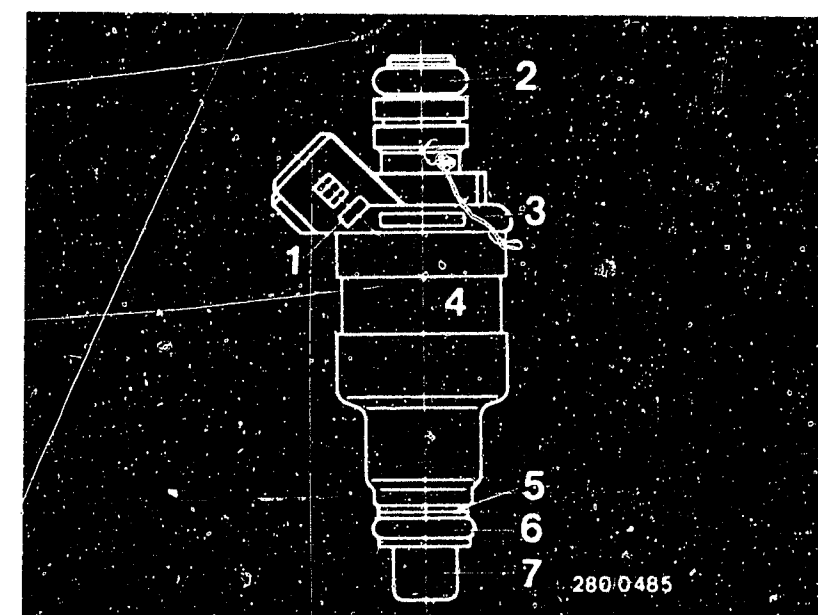
Continued on K5/K6

Continued on K3/K4



- 1 = Fastening screws  
2 = Solenoid-operated fuel-injection valves

- 1 = FD-marking  
2 = Top O-ring  
3 = Part No.  
4 = Solenoid-operated fuel-injection valve  
5 = Supporting plate  
6 = Bottom O-ring  
7 = Protective sleeve



K1

Engine missing in all driving conditions  
Saab



K2

Engine missing in all driving conditions  
Saab



Engine missing in all driving conditions (continued)

If the top O-ring (fuel distribution pipe connection) is swollen or damaged, it also must be taken out and replaced.

Caution! Before installation, the two O-rings may be greased only lightly (silicone grease Ft2v1). The other parts of the solenoid-operated fuel-injection valves must remain free of grease.

● Installation

- Carefully put the new solenoid-operated fuel-injection valve onto the fuel distribution pipe.
- Shove the retaining bracket into the slot until it latches. (Check the connection for leaks.)
- Put on the electrical connection (good contact).
- Carefully insert all 4 solenoid-operated fuel-injection valves into the intake manifold at the same time using the fuel distribution pipe.

Caution!

Do not damage any O-rings or solenoid-operated fuel-injection valve needles!

- Fasten the pressure regulator and the fuel distribution pipe with the screw (watch for leaks).

After testing or installation, the original condition of installation must be restored. Check for leaks.

yes

Continued on K5/K6



2 = Solenoid-operated fuel-injection valves

**K3**

Engine missing in all driving conditions  
Saab



**K4**

Engine missing in all driving conditions  
Saab



Engine missing in all driving conditions (continued)

yes

Is the hot-wire air-mass sensor OK mechanically and electrically?

- Hot wire unbroken?
- Resistances within tolerance?

Between Term. 6 and Term. 3:  
 $0...1100\ \Omega$

Between Term. 5 and Term. 3:  
 $3.6...4.1\ \Omega$

no

Removal

- Release both clamps on the air filter
- Release the hose clamp on the other side of the hot-wire air-mass sensor. Take out the hot-wire air-mass sensor.

Testing

• Visual inspection

- Is the connection plug put on correctly, the spring clamp snapped in, the plug free of twisting, with no plug prongs shoved back or poor contact. Watch for correct seating of the seal in the connecting plug.
- The wire screen OK on both sides?
- Is the hot wire broken? If yes, take out and replace the hot-wire air-sensor.

• Electrical test

- Disconnect connection plug. Set multimeter or motortester at  $\Omega$ -range.

Measurement of resistance

between Term. 6 and Term. 3:  $0...1100\ \Omega$

between Term. 5 and Term. 3:  $3.6...4.1\ \Omega$

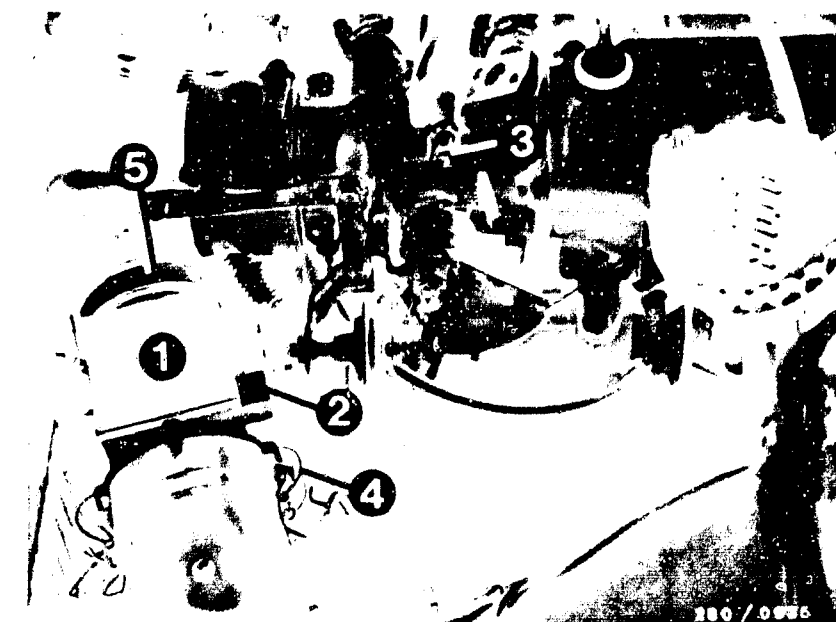
If there are deviations, take out and replace the hot-wire air-mass sensor.

Installation

- Connection plug put on correctly (good contact).
- Fasten the clamps.
- Put on the hoses, and tighten the hose clamps on the hot-wire air-mass sensor. (Watch for tight seals at the connections - unmetered air)

yes

Continued on K7/K8



- 1 = Hot-wire air-mass sensor  
2 = Potentiometer for idle-mixture adjustment  
4 = Clamps  
5 = Hose clamps

K5

Engine missing in all driving conditions  
Saab



K6

Engine missing in all driving conditions  
Saab



Engine missing in all driving conditions (continued)

yes

Are all hose lines and electrical lead connections correctly put on?  
Visual inspection.  
Has the intake system been checked for leaks?

no

Check that the hoses for the air intake system and the fuel line system have been put on correctly, without kinking or damage.

If needed, take out and replace hoses.

Correct leaks by using new seals or by tightening the connecting screws.

Checking for leaks

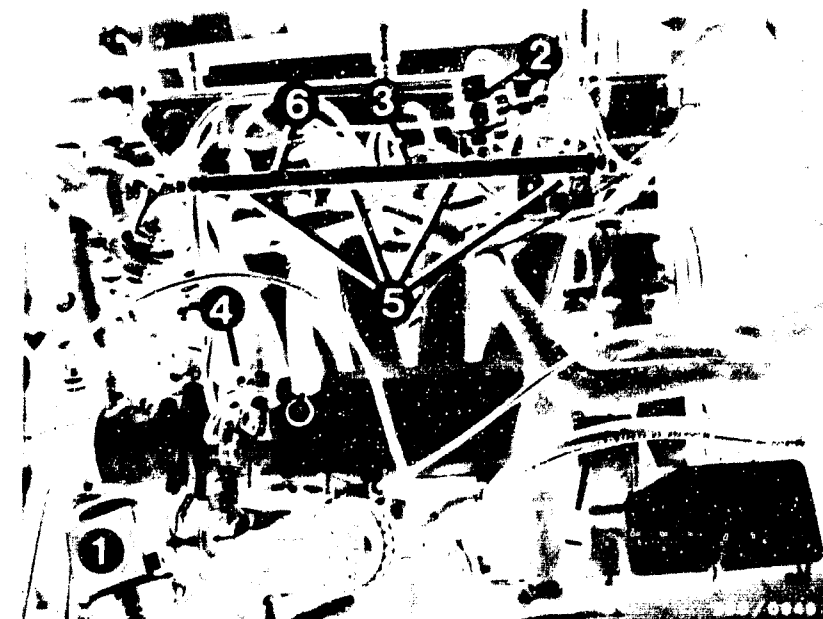
Seal off the exhaust pipe, unscrew the hose from the air filter to the air-mass sensor at the air-mass sensor and seal off the air-mass sensor channel (dust cover). Disconnect the hose after the auxiliary-air device. Seal off the auxiliary-air device connection. Using a compressed air gun (0.3 bar), blow into the hose to the intake manifold. In so doing, open the throttle valve all the way. Using soapy water, brush or spray all connections. Bubbling or foaming indicates leaks.

Caution!

Put all hoses back on and tighten hose clamps securely. Check for leaks.

yes

Continued on K9/K10



- 1 = Hot-wire air-mass sensor
- 2 = Pressure regulator
- 3 = Temperature sensor II (engine)
- 4 = Throttle-valve switch
- 5 = Solenoid-operated fuel-injection valve
- 6 = Ground terminal

**K7**

Engine missing in all driving conditions  
Saab



**K8**

Engine missing in all driving conditions  
Saab



Engine missing in all driving conditions (continued)

yes

Have the CO and idle been set correctly?

no

CO and idle adjustment

Exhaust-gas adjustment using the exhaust-gas measuring device with the engine at normal operating temperature and at idle speed.

- When connecting to the exhaust-gas evacuation system when running the engine in the workshop, make certain that no excessively great vacuum occurs in the evacuation system because that could, among other things, affect the result of the measurement of CO levels. For the connection to the exhaust-gas evacuation system, see the Figure at the top.

If turbo vehicles are connected to excessively high pressure, that can cause oil to be pulled through at the turbocharger seals.

This drenches the steel wool in the exhaust system with oil, which causes blue smoke at the exhaust pipe even after fairly long periods of driving.

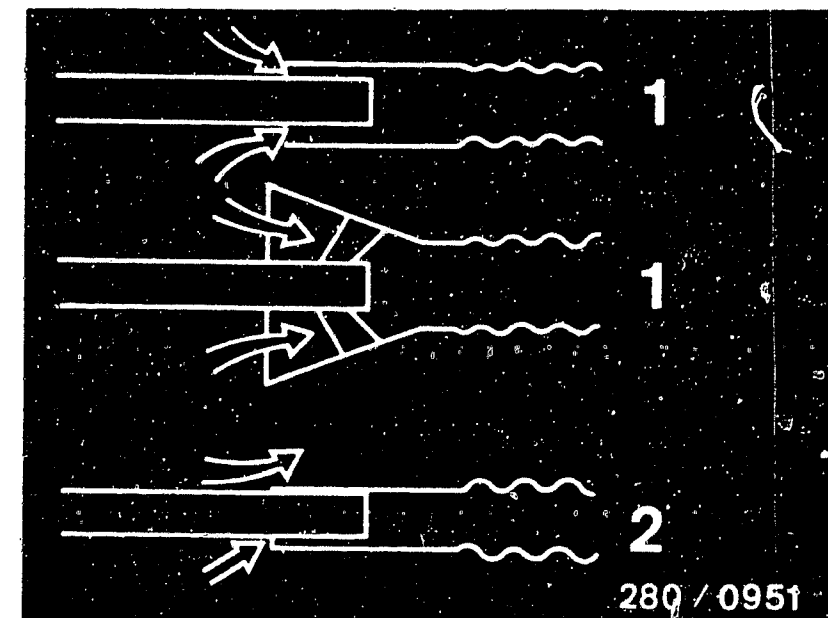
An excessive vacuum in the exhaust-gas evacuation system can be avoided by using exhaust-gas hoses with an open connection.

- An exhaust-gas recirculation, "EGR," has been installed in this vehicle due to certain exhaust-gas regulations.

yes

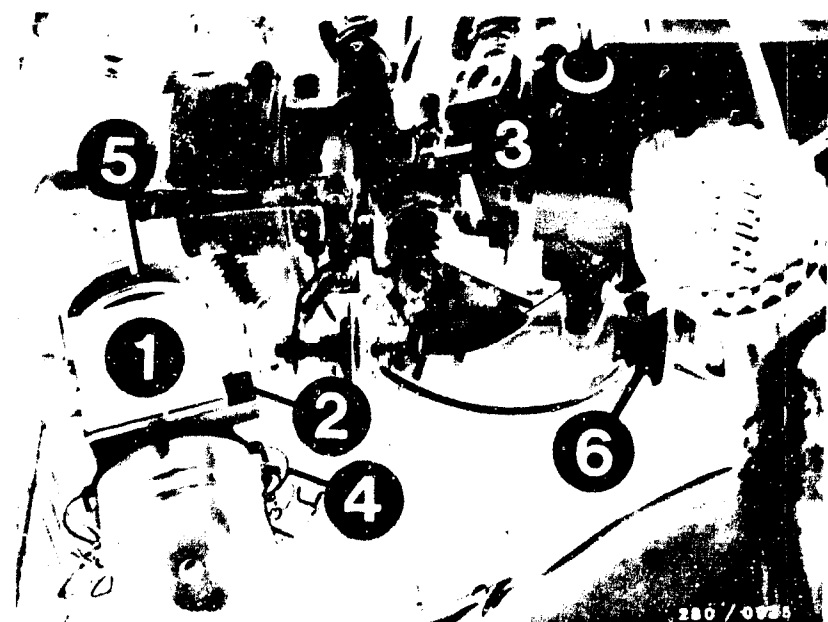
Continued on K11/K12

Continued on K11/K12



1 = correct  
2 = incorrect

6 = (Exhaust-gas) recirculation valve



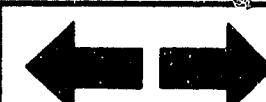
**K9**

Engine missing in all driving conditions  
Saab



**K10**

Engine missing in all driving conditions  
Saab



# Engine missing in all driving conditions (continued)

Are the idle speed and CO-level non-adjustable?

yes

no

yes

- Idle speed  
(Switch dimmer light on.)

Manual transmission and automatic transmission  
(selector lever in "Park"):

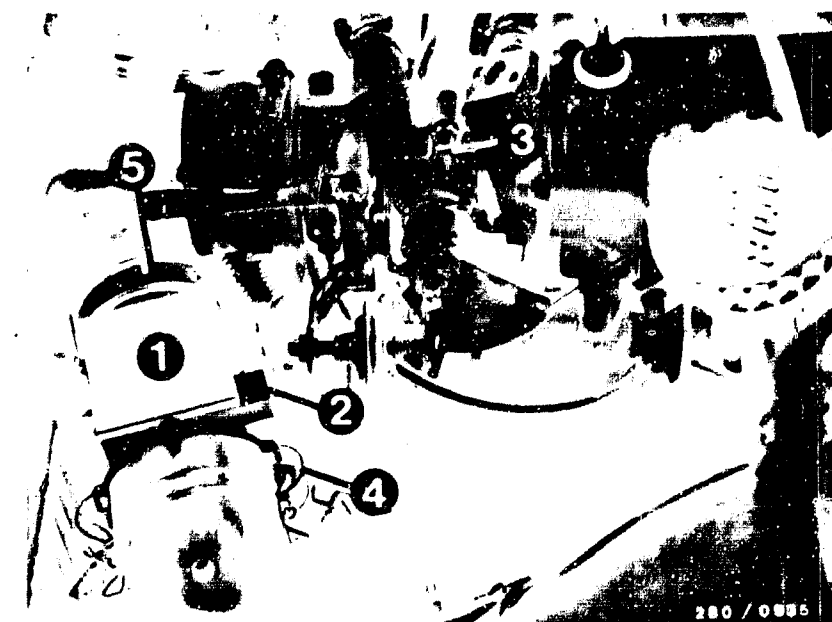
775 ... 925 min<sup>-1</sup>

- CO-setting 0.9 ... 1.6 vol. %CO

## Note:

When testing or adjusting the idle and CO, make certain by disconnecting and sealing the vacuum control line (figure at bottom, arrow) on the recirculation valve that the exhaust-gas recirculation system is not operating.

When operating the vehicle in countries that do not have stringent exhaust-gas regulations, it is not necessary to render the system inoperative. The combustion temperature is lowered by recirculation of the exhaust gas to the intake manifold, thus reducing the emission of nitrogen oxides.



2 = Potentiometer for idle CO-adjustment  
3 = Idle-speed-adjusting screw

1 = Recirculation valve  
2 = Thermostatic valve

Checking the customer complaint

"Engine missing in all driving conditions"

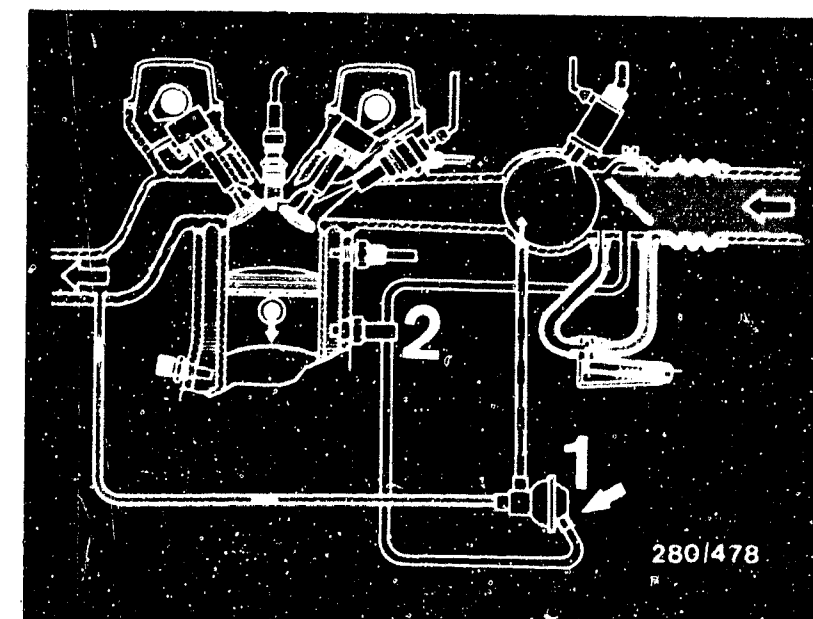
has been completed.

Has the customer complaint been corrected?

no

## Other possible defects

- The customer complaint has been incorrectly identified. (see Coordinates C3...C8.) If the defect has not been identified using the "targeted trouble-shooting," see the "detailed trouble-shooting."
- The engine is not OK mechanically. (Compression, valve setting, valve timing, wear on camshaft)



K11

Engine missing in all driving conditions  
Saab



K12

Engine missing in all driving conditions  
Saab



## POOR MILEAGE

### Trouble-shooting program according to customer complaint

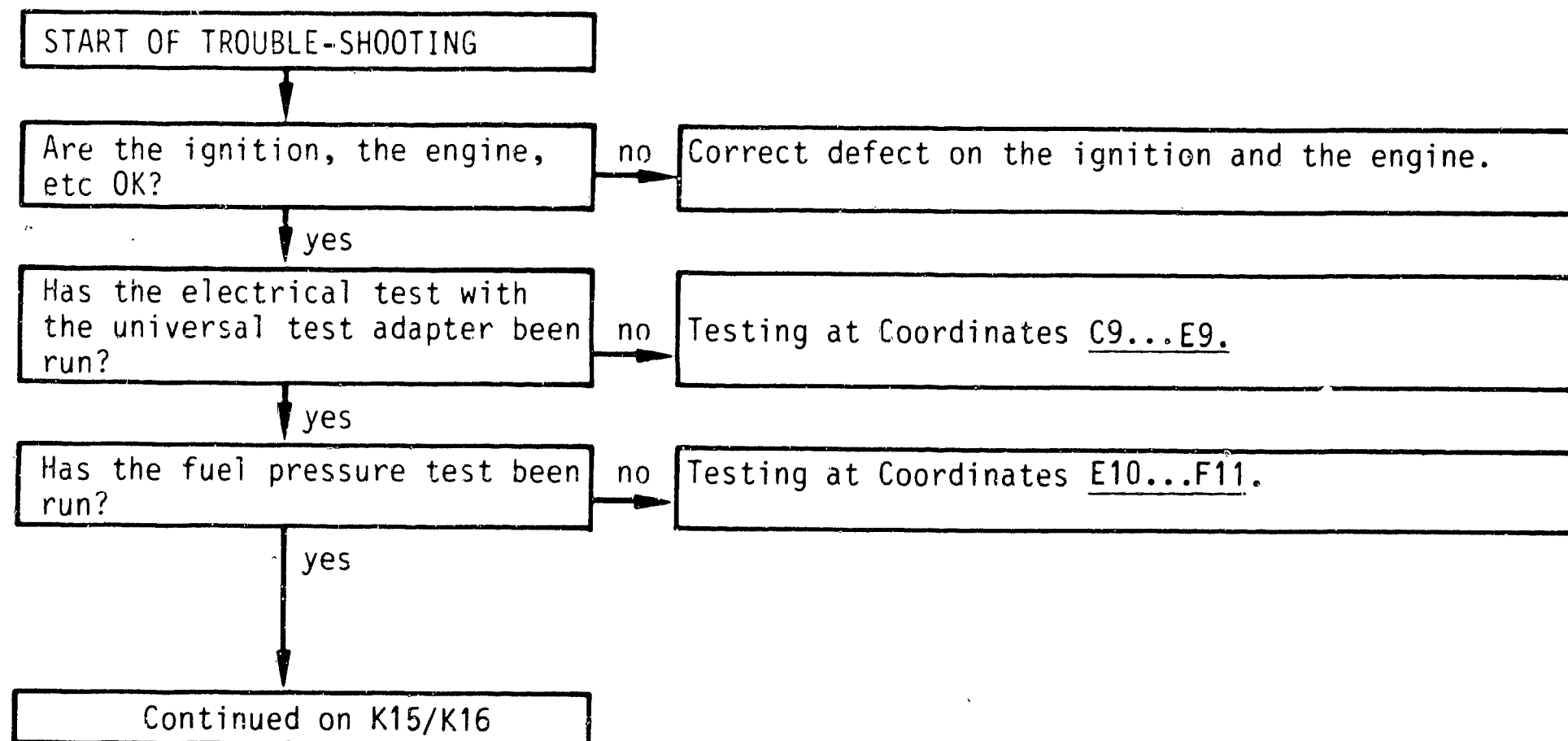
#### How to use the trouble-shooting program

Testing has been organized into 3 columns of boxes:

- In the column at the left are the questions for the tests being run.
- In the column at the center are descriptions of the tests and settings on components.
- The column at the right contains the illustrations that go with the text, and the legend for items in the illustrations.

If it is possible to answer the questions clearly with "yes" even without testing, proceed to the next question below.

If, on the other hand, the answer to the question is "no" and a defect is suspected, you must shift to the column at the center and run the tests indicated there. On completion of the testing, the trouble-shooting is continued at that point at which the shift was made earlier.

**K13**

Poor mileage  
Saab

**K14**

Poor mileage  
Saab





# Poor mileage (continued)

yes

Are the solenoid-operated fuel-injection valves OK with regard to leaks?

no

yes

## Checking the solenoid-operated fuel-injection valves for leaks:

- Take out the fuel distribution pipe and the solenoid-operated fuel-injection valves:
    - Release the fastening screws on the fuel-distribution pipe and the pressure regulator.
    - Carefully pull all 4 solenoid-operated fuel-injection valves out of the cylinder head at the same time.
  - Build up the fuel pressure:
    - Disconnect the control unit plug on the LH-control unit.
    - Make an auxiliary lead (lead diameter 1.5 mm with blade terminals 6.3 mm at both ends).
- Until 7.85:
- Disconnect 2-pin plug connection and connect auxiliary cable.
- This plug connection is between the brake power assist unit and the coolant overflow reservoir.
- As of 8.85:
- Pull out pump fuse no. 30 and hazard-warning and turn-signal system no. 27 and bridge with auxiliary cable.
- Ignition "ON", in-tank electric fuel pump should operate.

## • Test specification:

Within 60 sec. there must be no drop formation at mouth of solenoid-operated injection valve.  
In case of defect, replace injection valve.

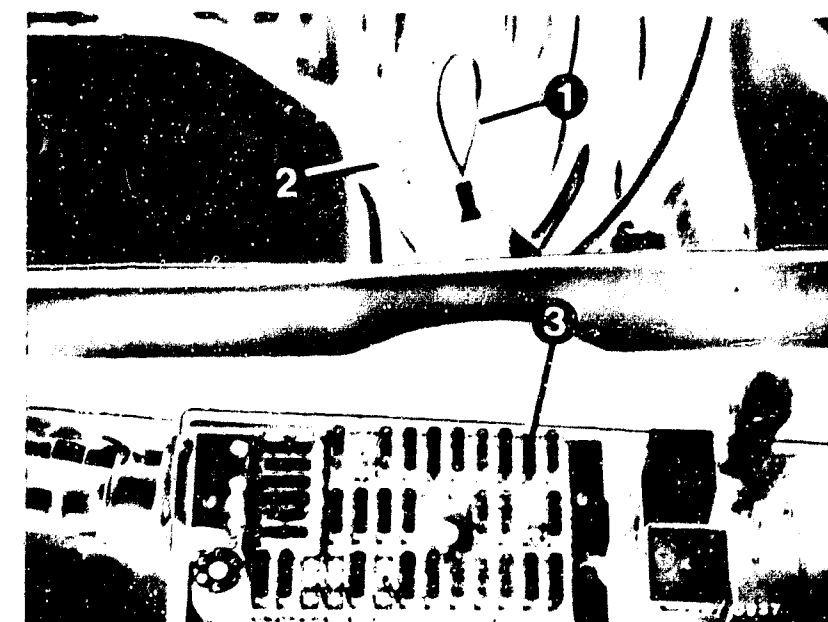
Continued on K19/K20

Continued on K17/K18



1 = Fastening screw  
3 = Solenoid-operated fuel-injection valves

1 = Auxiliary lead  
2 = 2-pin plug connection



K15

Poor mileage  
Saab



K16

Poor mileage  
Saab





● Removal

- Disconnect the electrical connection
- Carefully push the retaining bracket out of the slot
- Carefully pull the solenoid-operated fuel-injection valve out of the fuel distribution pipe.

Caution! Catch any fuel that runs out. Do not allow it to drip on hot portions of the engine.

● Installation

Caution!

Before installation, the two O-rings may be greased only lightly (silicone grease Ft 2 v 1). The other parts of the solenoid-operated fuel-injection valves must remain free of grease.

- Carefully put the new solenoid-operated fuel-injection valve on the fuel distribution pipe.
- Shove the retaining bracket into the slot on the solenoid-operated fuel-injection valve until the bracket latches. (Check the connection for leaks.)

Caution!

After testing, restore the original condition of installation.  
Check for leaks (unmetered air).

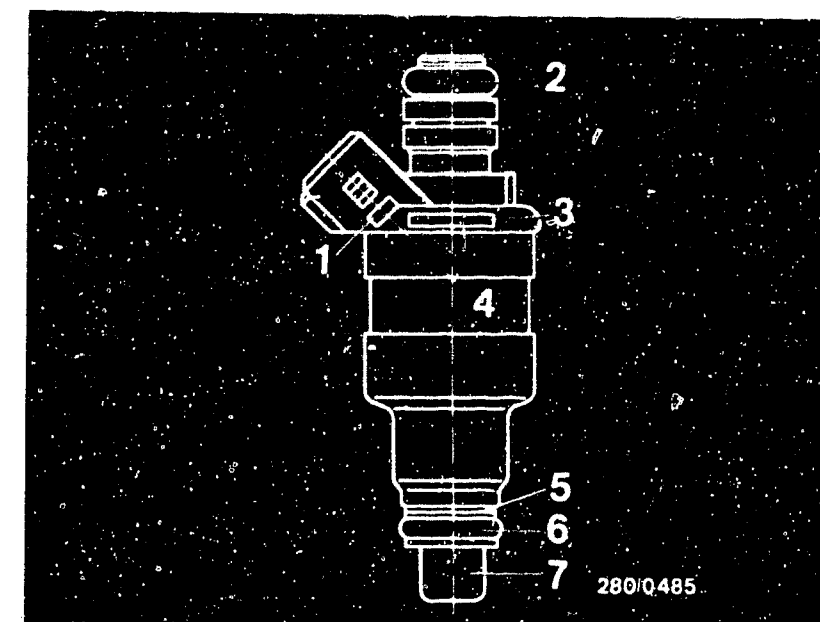
yes

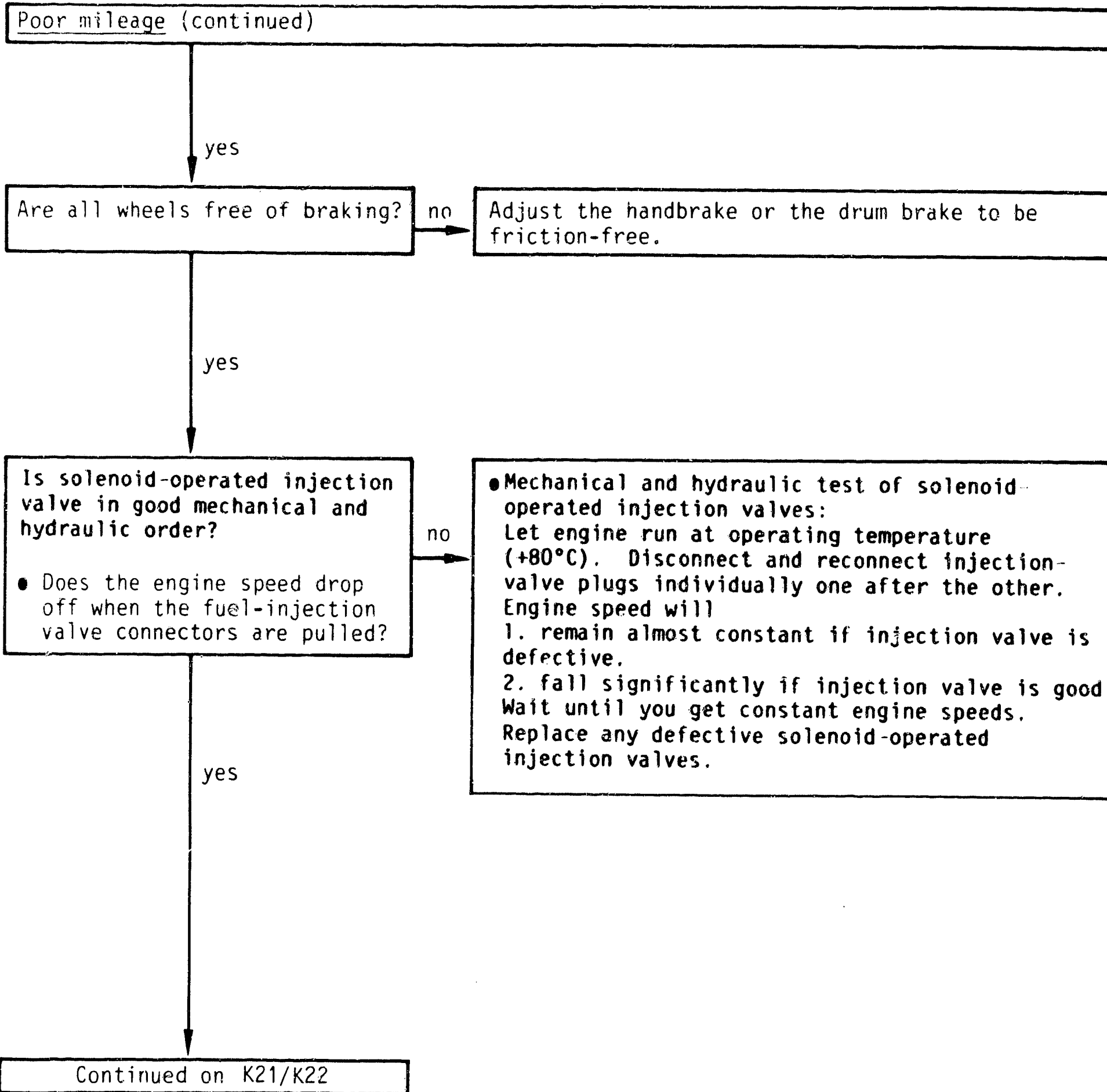
Continued on K19/K20



- 1 = Fastening screws
- 2 = Solenoid-operated fuel-injection valves

- 1 = FD-marking
- 2 = Top O-ring
- 3 = Part NO.
- 4 = Solenoid-operated fuel-injection valve
- 5 = Supporting plate (yellow, 2 mm)
- 6 = Bottom O-ring
- 7 = Protective sleeve





2 = Solenoid-operated fuel-injection valves

**K19**

Poor mileage  
Saab



**K20**

Poor mileage  
Saab



# Poor mileage (continued)

yes

Are the solenoid-operated fuel-injection valves OK?

- Removal and installation
- Is the O-ring OK?

no

yes

Continued on L1/L2

## • Removal

Take out the fuel distribution pipe and the solenoid-operated fuel-injection valves.

- Release the fastening screws on the fuel distribution pipe and the pressure regulator.
- Carefully pull all 4 solenoid-operated fuel-injection valves simultaneously out of the cylinder head.

Take out and replace the solenoid-operated fuel-injection valve.

- Disconnect the electrical connection.
- Carefully shove the retaining bracket out of the slot.
- Carefully pull the defective solenoid-operated fuel-injection valve out of the fuel distribution pipe.

Caution! Catch any fuel that runs out. Do not allow to drip on hot parts of the engine.

## • If the O-ring is defective and/or swollen

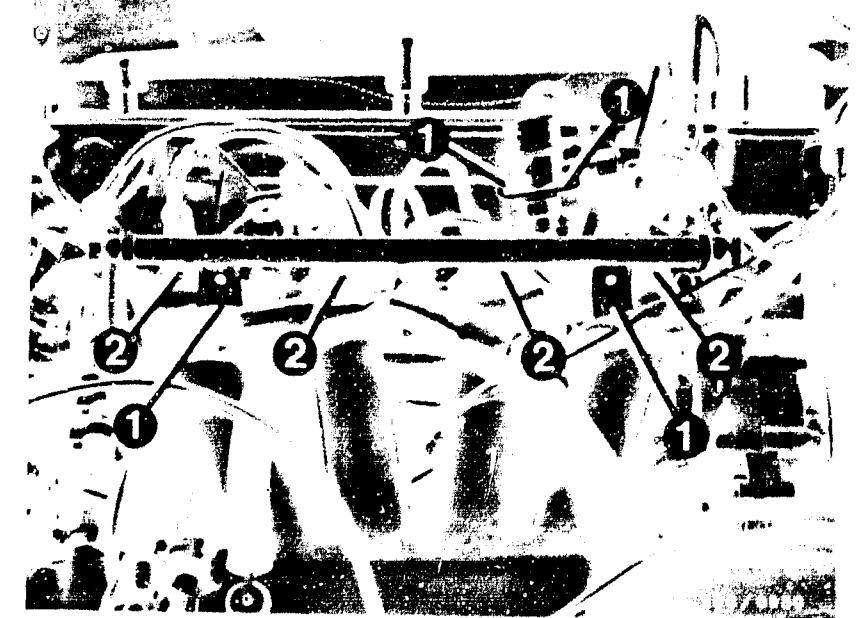
Cut the bottom O-ring (intake tube) into pieces. Caution! Do not damage the protective sleeve. Pull a new O-ring over the protective sleeve and its shoulder. Do not damage any parts in so doing.

## • Use parts kit 1 287 010 704.

When working on the solenoid-operated fuel-injection valves, do not damage the valve needles. If the top O-ring (fuel distribution pipe connection) is swollen or damaged, it also must be taken out and replaced.

## Caution!

Before installation, the two O-rings may be greased only lightly (silicone grease Ft 2 v 1). The other parts of the solenoid-operated fuel-injection valves must remain free of grease.



1 = Fastening screws

2 = Solenoid-operated fuel-injection valves

1 = FD-marking

2 = Top O-ring

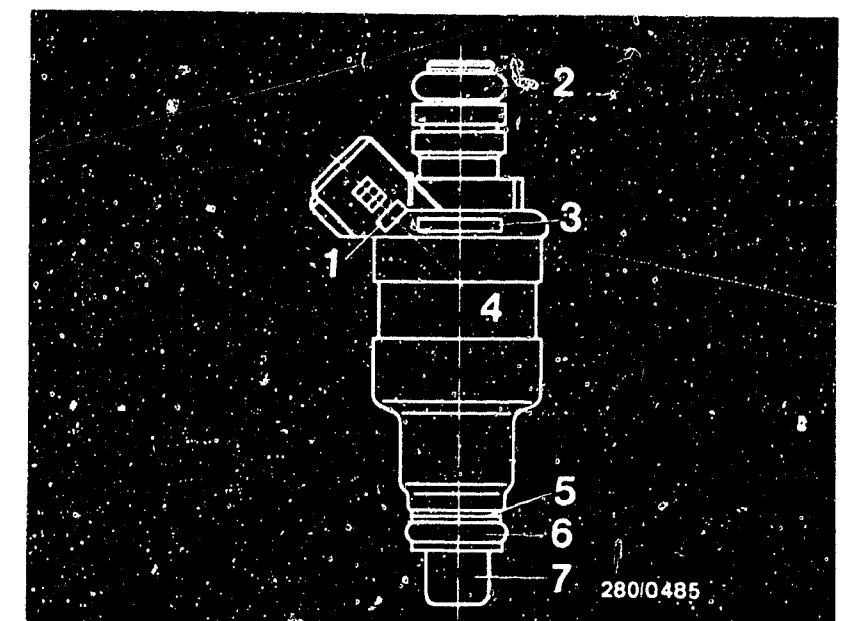
3 = Part No.

4 = Solenoid-operated fuel-injection valve

5 = Supporting plate

6 = Bottom O-ring

7 = Protective sleeve



K21

Poor mileage  
Saab



K22

Poor mileage  
Saab



Poor mileage (continued)

● Installation

- Carefully put the new solenoid-operated fuel-injection valve onto the fuel distribution pipe.
- Shove the retaining bracket into the slot until it latches. (Check the connection for leaks.)
- Put on the electrical connection (good contact).
- Carefully insert all 4 solenoid-operated fuel-injection valves into the intake manifold at the same time using the fuel distribution pipe.

Caution!

Do not damage any O-rings or solenoid-operated fuel-injection valve needles!

- Fasten the pressure regulator and the fuel distribution pipe with the screw (watch for leaks).

After testing or installation, the original condition of installation must be restored. Check for leaks.

yes

Continued on L1/L2



2 = Solenoid-operated fuel-injection valves

1 = FD-marking

2 = Top O-ring

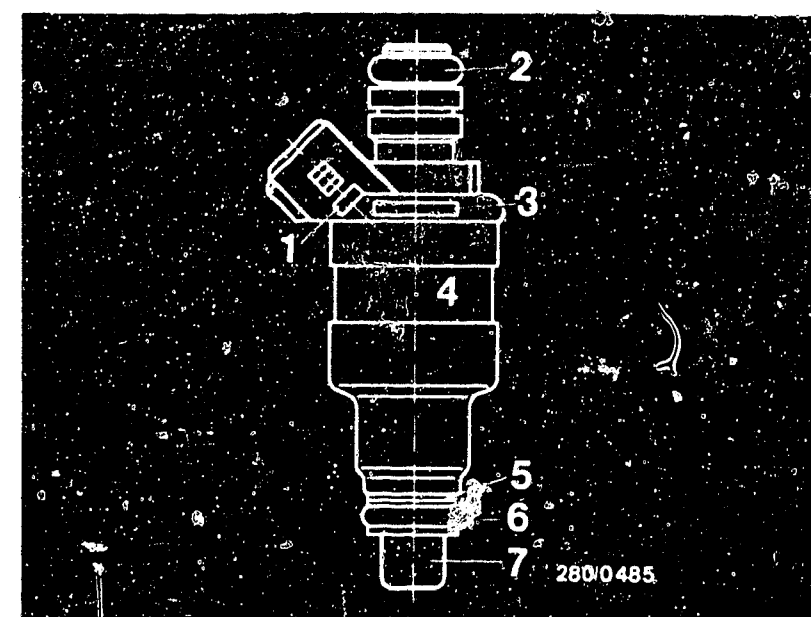
3 = Part No.

4 = Solenoid-operated fuel-injection valve

5 = Supporting plate

6 = Bottom O-ring

7 = Protective sleeve



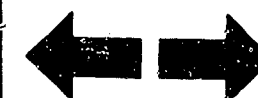
**K23**

Poor mileage  
Saab



**K24**

Poor mileage  
Saab



## Poor mileage (continued)

yes

Is the hot-wire air-mass sensor OK mechanically and electrically?

- Hot wire unbroken?
- Resistances within tolerance?

Between Term. 6 and Term. 3:  
0...1100  $\Omega$

Between Term. 5 and Term. 3:  
3.6...4.1  $\Omega$

no

### Removal

- Release both clamps on the air filter
- Release the hose clamp on the other side of the hot-wire air-mass sensor. Take out the hot-wire air-mass sensor.

### Testing

#### • Visual inspection

- Is the connection plug put on correctly, the spring clamp snapped in, the plug free of twisting, with no plug prongs shoved back or poor contact. Watch for correct seating of the seal in the connecting plug.
- The wire screen OK on both sides?
- Is the hot wire broken? If yes, take out and replace the hot-wire air-sensor.

#### • Electrical test

- Disconnect connection plug. Set multimeter or motortester at  $\Omega$ -range.

#### Measurement of resistance

between Term. 6 and Term. 3: 0...1100  $\Omega$

between Term. 5 and Term. 3: 3.6...4.1  $\Omega$

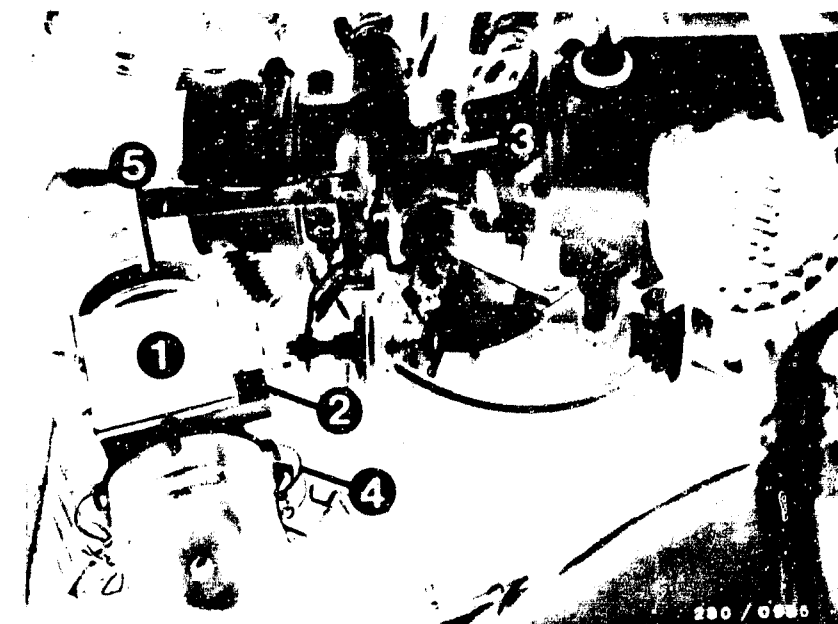
If there are deviations, take out and replace the hot-wire air-mass sensor.

### Installation

- Connection plug put on correctly (good contact).
- Fasten the clamps.
- Put on the hoses, and tighten the hose clamps on the hot-wire air-mass sensor. (Watch for tight seals at the connections - unmeasured air)

yes

Continued on L3/L4



- 1 = Hot-wire air-mass sensor
- 2 = Potentiometer for idle-mixture adjustment
- 4 = Clamps
- 5 = Hose clamps

L1

Poor mileage  
Saab



L2

Poor mileage  
Saab



# Poor milage (continued)

yes

Have the CO and idle been set correctly?

no

yes

Continued on L5/L6

## CO and idle adjustment

Exhaust-gas adjustment using the exhaust-gas measuring device with the engine at normal operating temperature and at idle speed.

- When connecting to the exhaust-gas evacuation system when running the engine in the workshop, make certain that no excessively great vacuum occurs in the evacuation system because that could, among other things, affect the result of the measurement of CO levels. For the connection to the exhaust-gas evacuation system, see the Figure at the top.

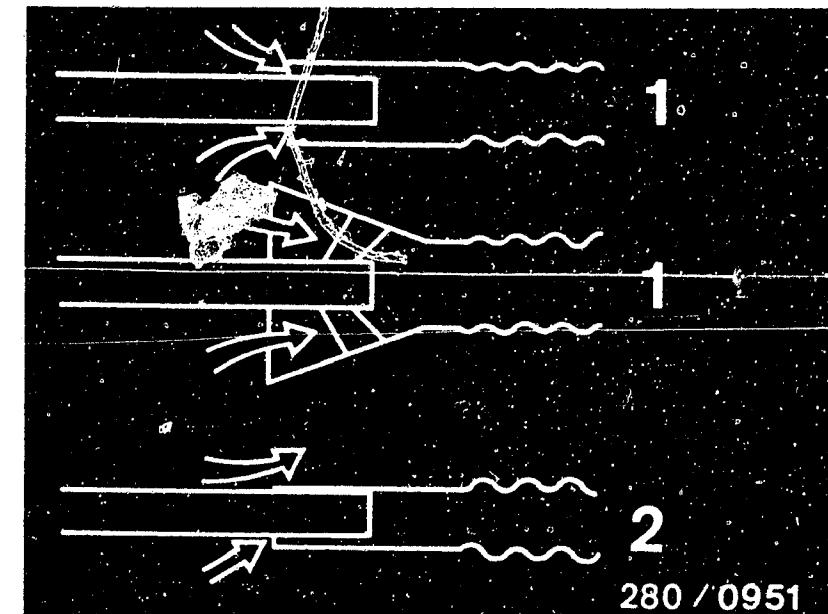
If turbo vehicles are connected to excessively high pressure, that can cause oil to be pulled through at the turbocharger seals.

This drenches the steel wool in the exhaust system with oil, which causes blue smoke at the exhaust pipe even after fairly long periods of driving.

An excessive vacuum in the exhaust-gas evacuation system can be avoided by using exhaust-gas hoses with an open connection.

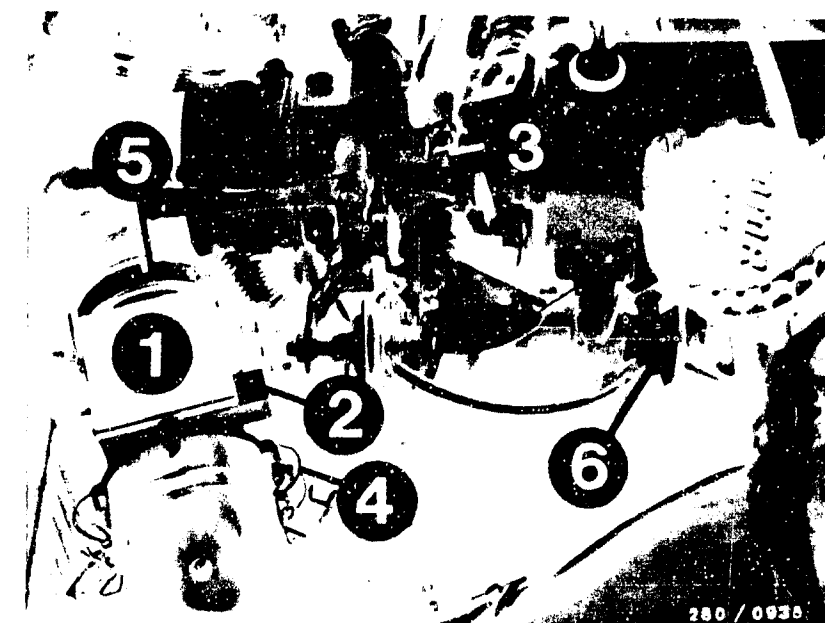
- An exhaust-gas recirculation, "EGR," has been installed in this vehicle due to certain exhaust-gas regulations.

Continued on L5/L6



1 = correct  
2 = incorrect

6 = (Exhaust-gas) recirculation valve



L3

Poor mileage  
Saab



L4

Poor mileage  
Saab



# Poor mileage (continued)

Are the idle speed and CO-level non-adjustable?

yes

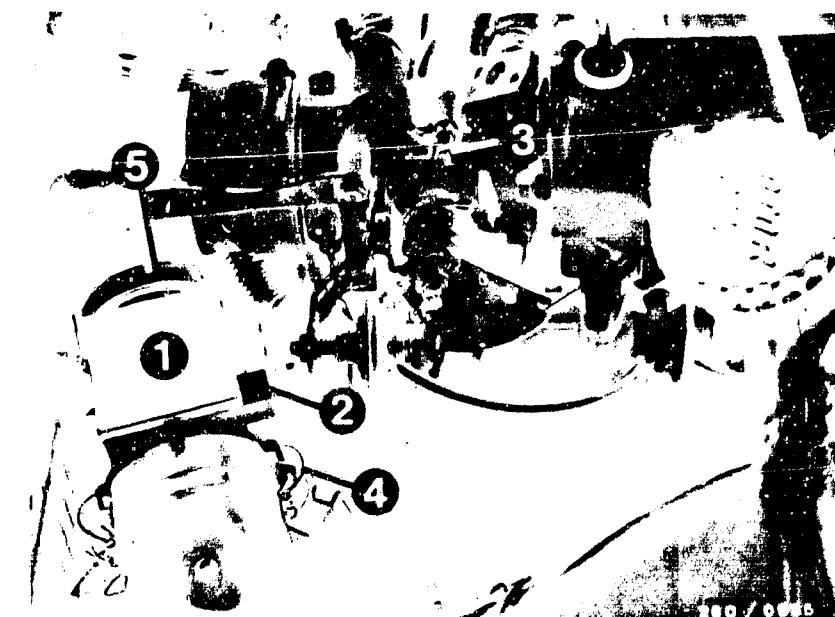
yes

• Idle speed  
(Switch dimmer light on.)

Manual transmission and automatic transmission (selector lever in "Park"):  
775 ... 925 min<sup>-1</sup>

• CO-setting: 0.9 ... 1.6 vol. %CO

Note:  
When testing or adjusting the idle and CO, make certain by disconnecting and sealing the vacuum control line (figure at bottom, arrow) on the recirculation valve that the exhaust-gas recirculation system is not operating.  
When operating the vehicle in countries that do not have stringent exhaust-gas regulations, it is not necessary to render the system inoperative. The combustion temperature is lowered by recirculation of the exhaust gas to the intake manifold, thus reducing the emission of nitrogen oxides.



2 = Potentiometer for idle CO-adjustment  
3 = Idle-speed-adjusting screw

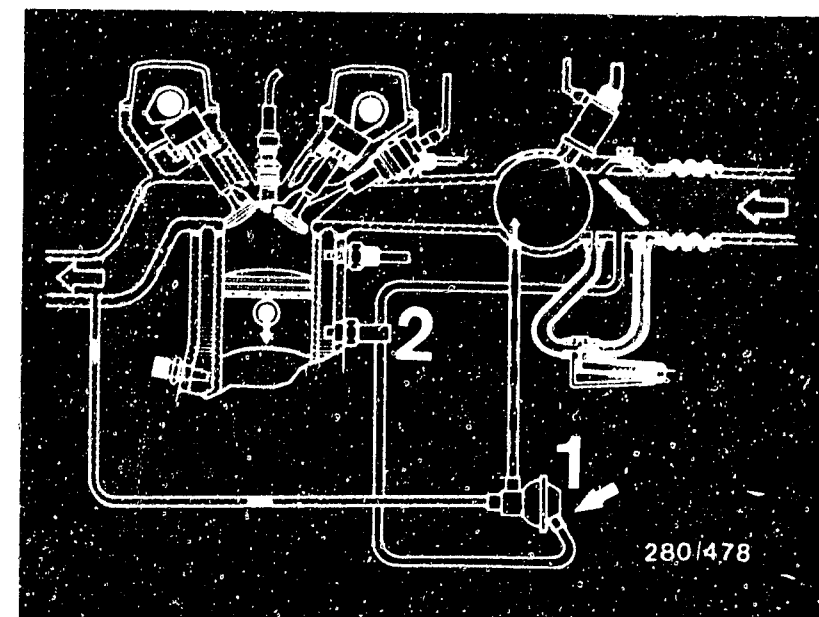
1 = Recirculation valve  
2 = Thermostatic valve

Checking the customer complaint  
"Poor mileage"  
has been completed.  
Has the customer complaint been corrected?

no

Other possible defects

- The customer complaint has been incorrectly identified. (see Coordinates C3...C8.)  
If the defect has not been identified using the "targeted trouble-shooting," see the "detailed trouble-shooting."
- The engine is not OK mechanically.  
(Compression, valve setting, valve timing, wear on camshaft)



## INSUFFICIENT MAX. POWER OR MAX. DRIVING SPEED

### Trouble-shooting program according to customer complaint

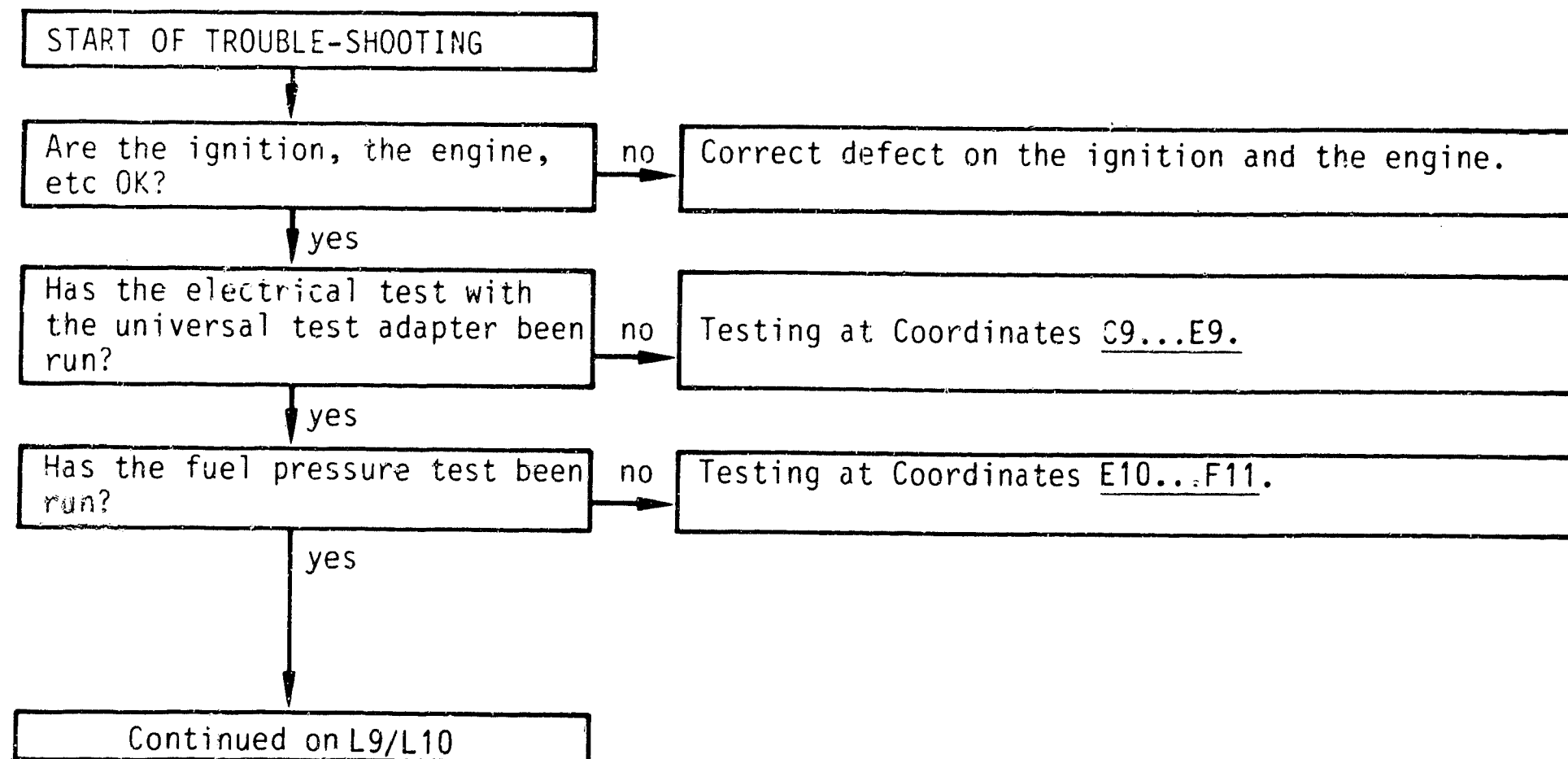
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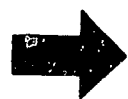
If it is possible to answer the questions clearly with "yes" even without testing, proceed to the next question below.

If, on the other hand, the answer to the question is "no" and a defect is suspected, you must shift to the column at the center and run the tests indicated there. On completion of the testing, the trouble-shooting is continued at that point at which the shift was made earlier.



**L7**

No max. power or driving speed  
Saab

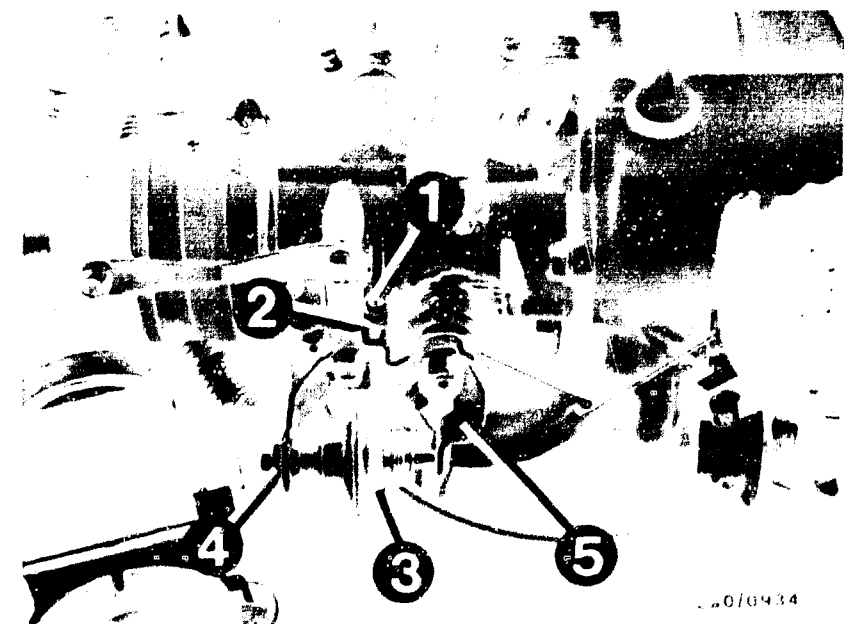
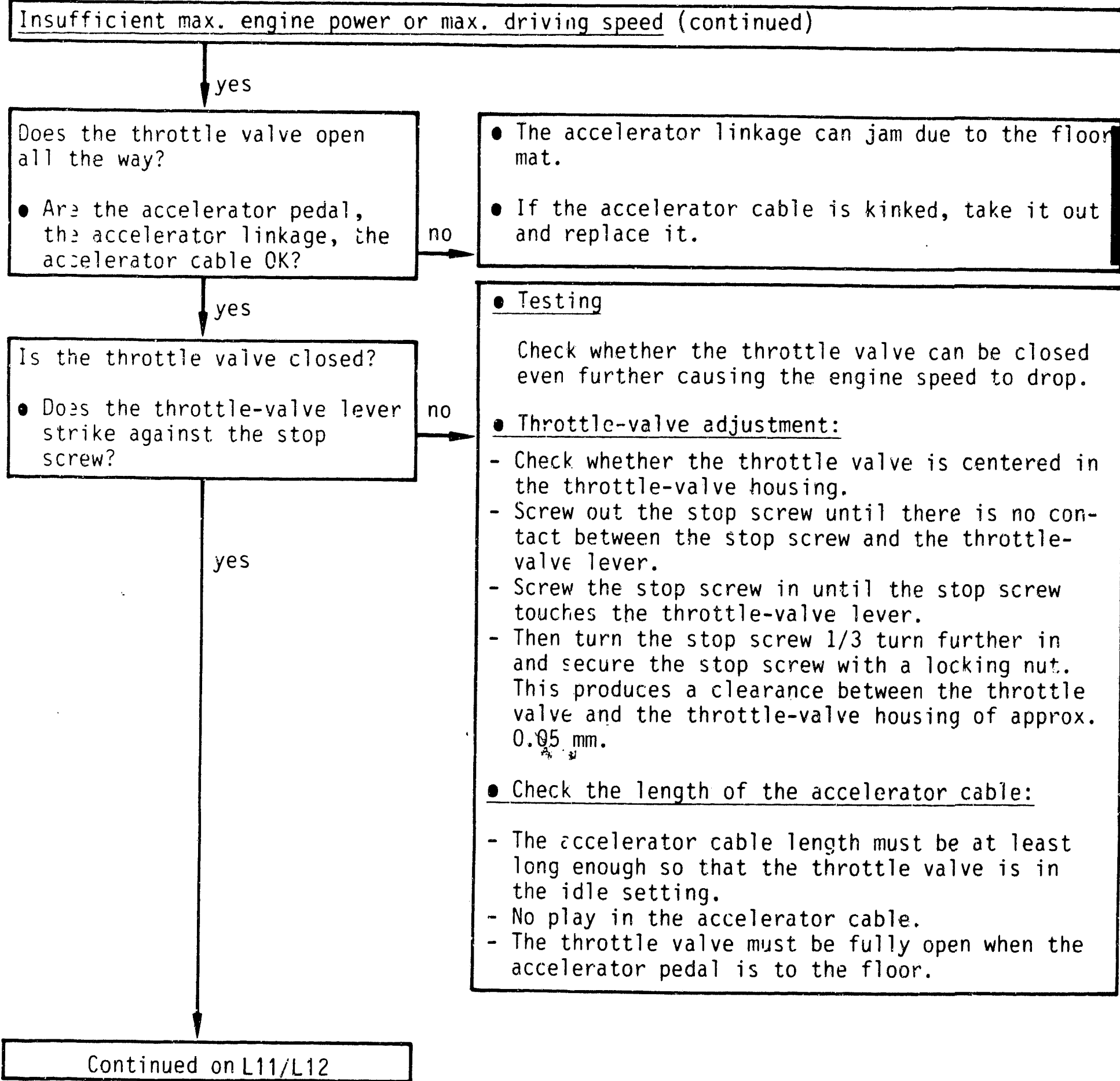


**L8**

No max. power or driving speed  
Saab







- 1 = Throttle-valve stop screw  
 2 = Throttle-valve stop  
 3 = Throttle-valve damper  
 4 = Locking nut, for adjusting the throttle-valve damper  
 5 = Throttle-valve lever

**L9**

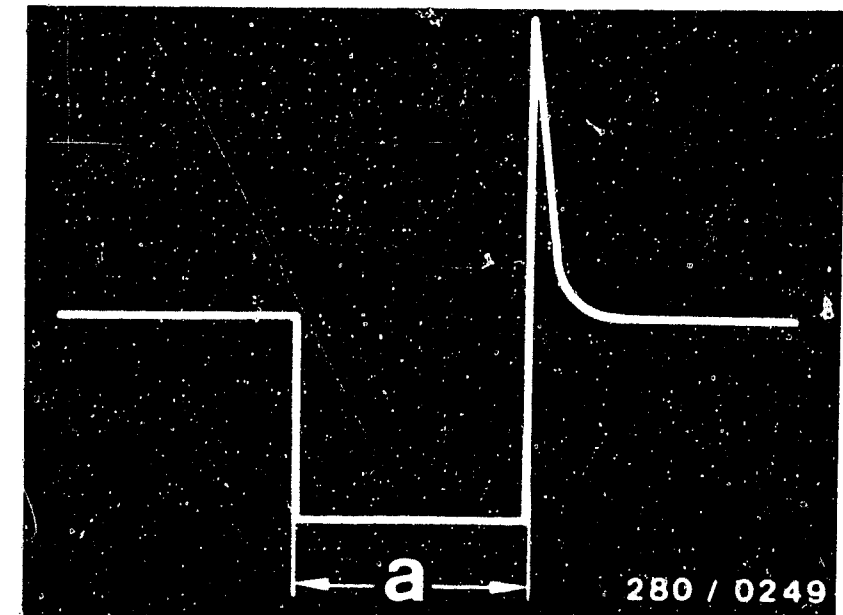
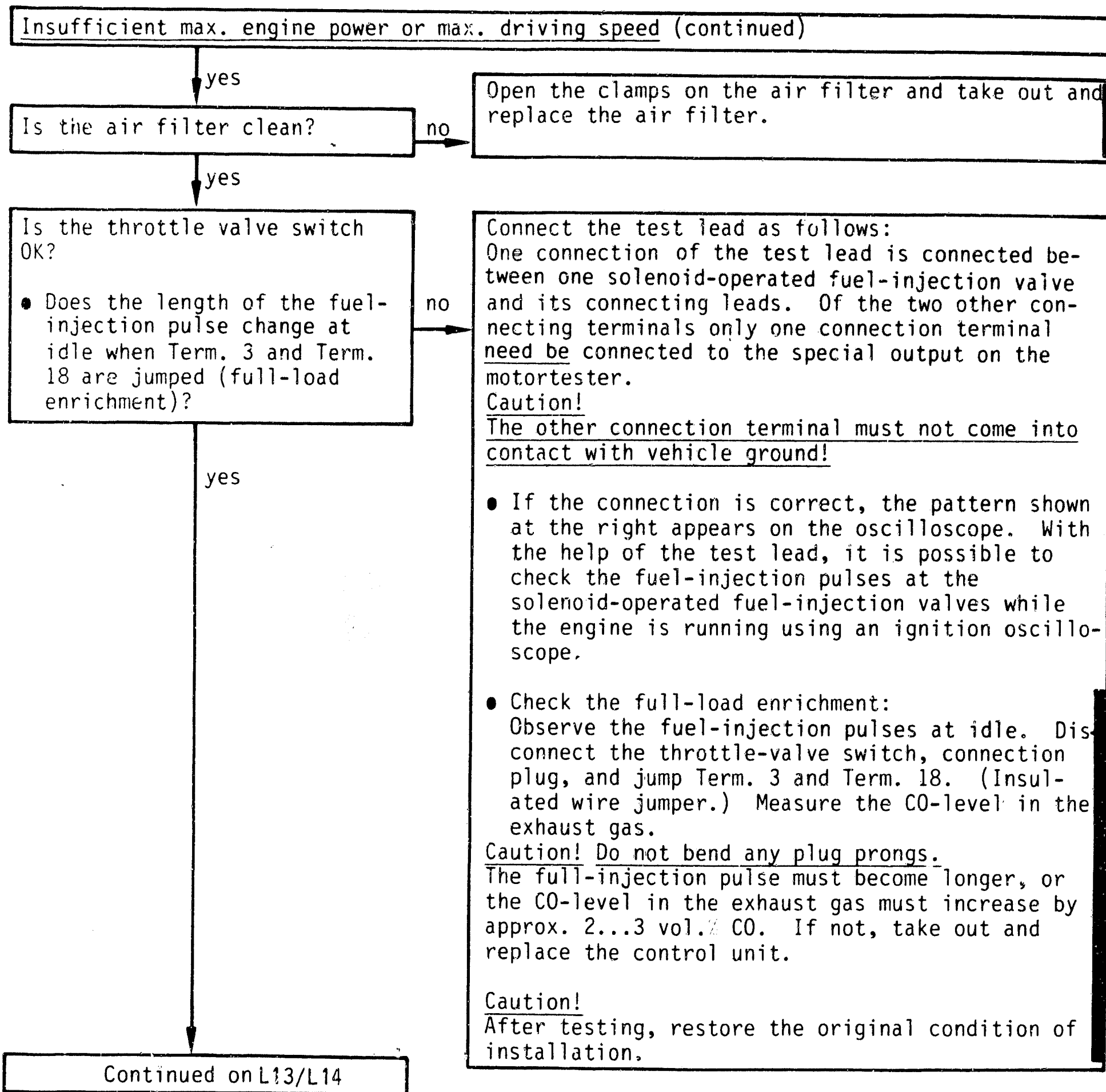
No max. engine power  
Saab



**L10**

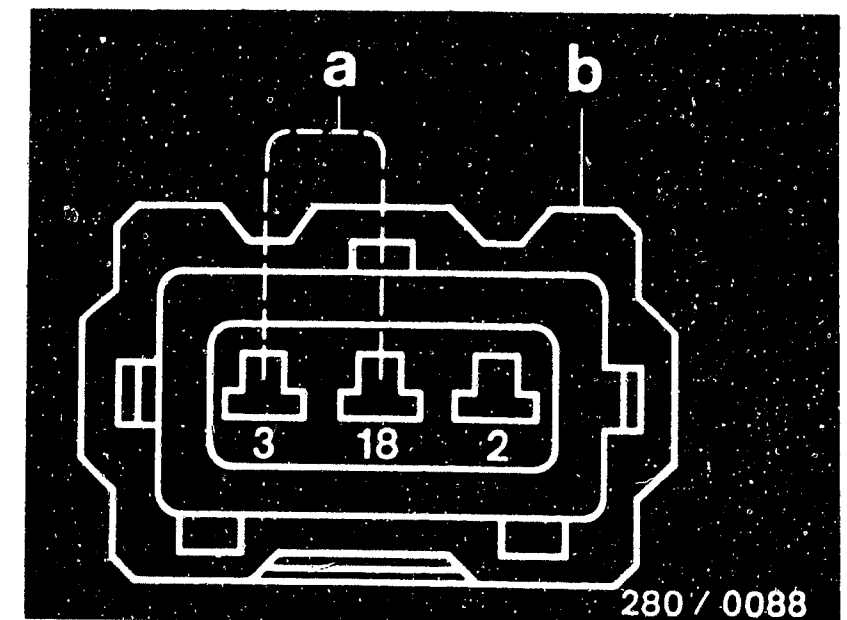
No max. engine power  
Saab





Fuel-injection pulse for a switched output stage (measured at the solenoid-operated fuel-injection valve)  
a = Pulse length (dependent on the engine load)

a = Wire jumper (insulated)  
b = Throttle-valve switch (- connection plug)



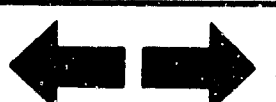
L11

No max. engine power  
Saab



L12

No max. engine power  
Saab



Insufficient max. power engine power or max. driving speed (continued)

yes

Is the fuel delivery from the electric fuel pump OK?

Test specification:  
min. 900 cm<sup>3</sup>/30 secs

no

● Measuring fuel delivery

To test, take apart the connection between the fuel return connection (on the pressure regulator) and the fuel return pipe (to the fuel tank).

- Connect a hose and direct it into a 5 l container with measuring scale.
- Disconnect the control unit plug on the LH-control unit.
- Make an auxiliary lead (lead Ø 1.5 mm, and blade terminals 6.3 mm at both ends).
- Take apart the 2-pole plug connection and insert the auxiliary lead. (The plug connection is between the brake servo assist unit and the cooling water overflow reservoir.)
- Ignition "ON". The in-tank electric fuel pump must run.

Test specification: min. 900 cm<sup>3</sup>/30 secs

Caution!

After completion of the test, it is absolutely necessary to remove the auxiliary lead and restore the plug connection to the original condition.

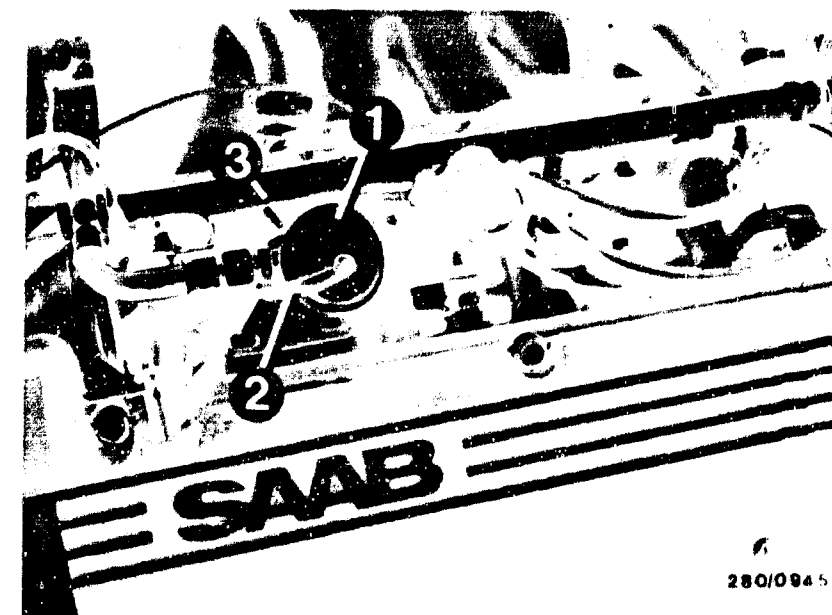
Corrective action if the test specification is not attained:

- Fuel filter is clogged: take it out and replace it.
- Voltage at the connection terminals for the electric fuel pump with the engine running: min. 12 V. If not, clean contacts, correct any poor ground connection, take out and replace the leads. Check the pump fuses.
- Pressure regulator is defective: take it out and replace it.

yes

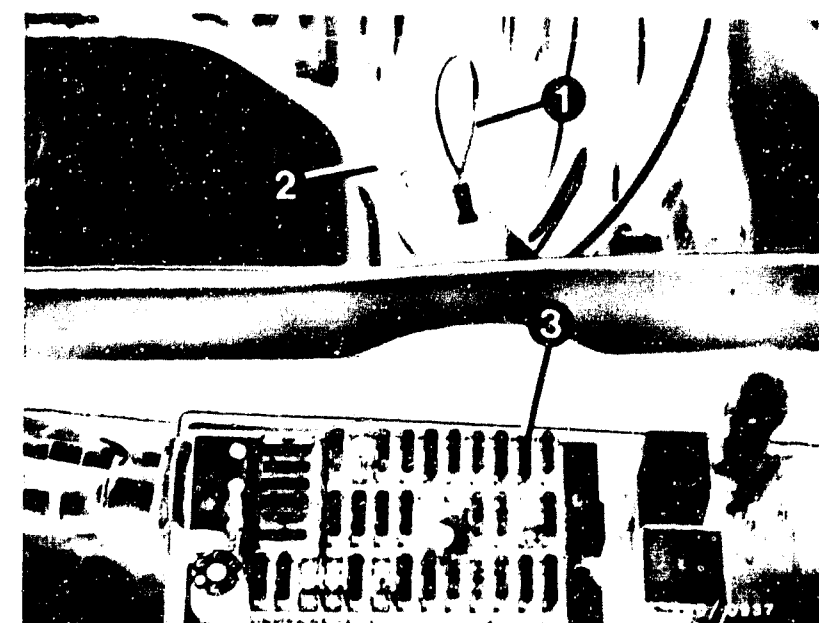
Continued on L15/L16

Continued on L15/L16



- 1 = Pressure regulator  
2 = Intake manifold connection  
3 = Fuel return line

- 1 = Auxiliary lead  
2 = 2-pin plug connection



**L13**

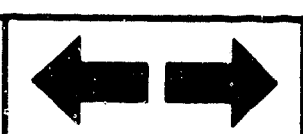
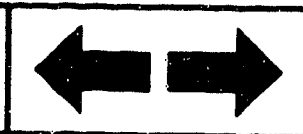
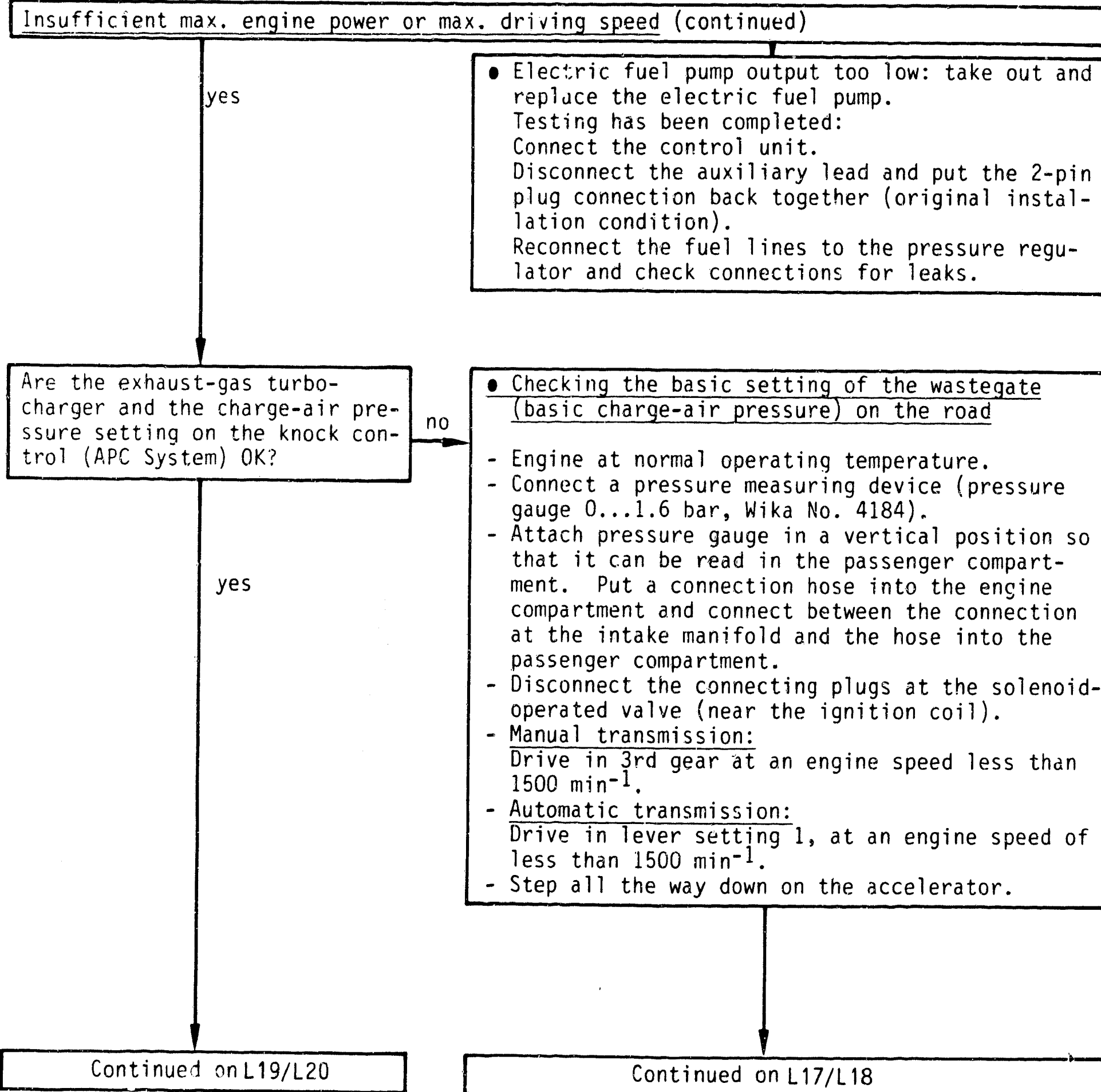
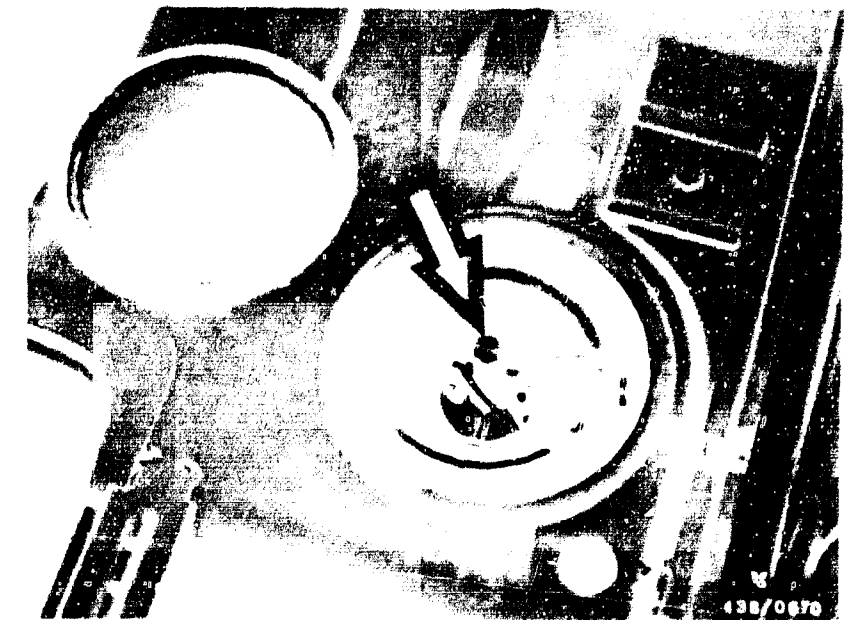
No max. engine power  
Saab



**L14**

No max. engine power  
Saab





Insufficient max. engine power or max driving speed (continued)

yes

- When the engine speed approaches  $3000 \text{ min}^{-1}$ , brake the vehicle with the accelerator pedal floored, so as to produce the full load at  $3000 \text{ min}^{-1}$ .
- Now check on the pressure gauge to see that the basic setting for charge-air pressure is as follows: specified value  $0.25 \dots 0.33 \text{ bar}$ .  
Caution!  
The engine must be fully at normal operating temperature.
- When measuring the charge-air pressure during driving, the test must be run as quickly as possible (approx.  $3 \dots 5 \text{ secs}$ ) in order to prevent excessive temperatures on the brake linings.
- Drive the vehicle for at least 1 kilometer between individual measurements and after completion of the measurement so that the brake lining can cool off.

The basic setting for charge-air pressure is merely a point of departure for the operation of the knock control (APC-System) and has no direct effect on the charge-air pressure level, i.e., on the engine output that is attained when the knock control is connected.

Increasing the basic setting for charge-air pressure above  $0.30 + 0.03 \text{ bar}$  does not produce any increase in engine power.

The maximum charge-air pressure which brings about the correct power output on the engine is controlled by the knock control.

- Connect the connecting plug to the solenoid-operated valve.

Continued on L19/L20

Continued on L19/L20

**L17**

No max. engine power  
Saab



**L18**

No max. engine power  
Saab



Insufficient max. engine power or max. driving speed (continued)

● Checking the charge-air pressure

- Engine at normal operating temperature.
- At full load, the charge-air pressure must rise between 0.7 ... 0.8 bar.

If the two test specifications are not attained, the exhaust-gas turbocharger and/or the knock control (APC system) must be rechecked.

yes

Is solenoid-operated injection valve in good mechanical and hydraulic order?

no

● **Mechanical and hydraulic test of solenoid-operated injection valves:**

Let engine run at operating temperature (+80°C). Disconnect and reconnect injection-valve plugs individually one after the other. Engine speed will

1. remain almost constant if injection valve is defective.
2. fall significantly if injection valve is good. Wait until you get constant engine speeds. Replace any defective solenoid-operated injection valves.

yes

Continued on L21/L22



2 = Solenoid-operated fuel-injection valves

**L19**

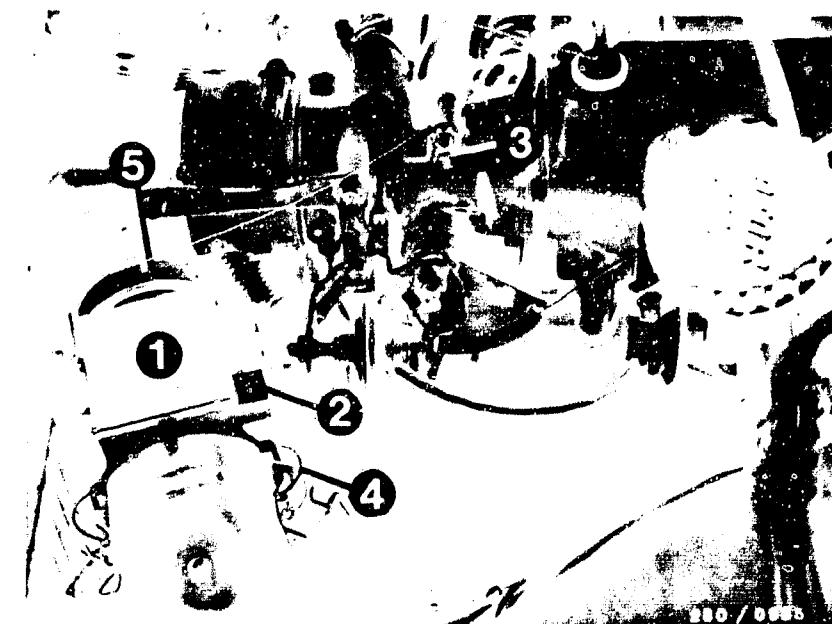
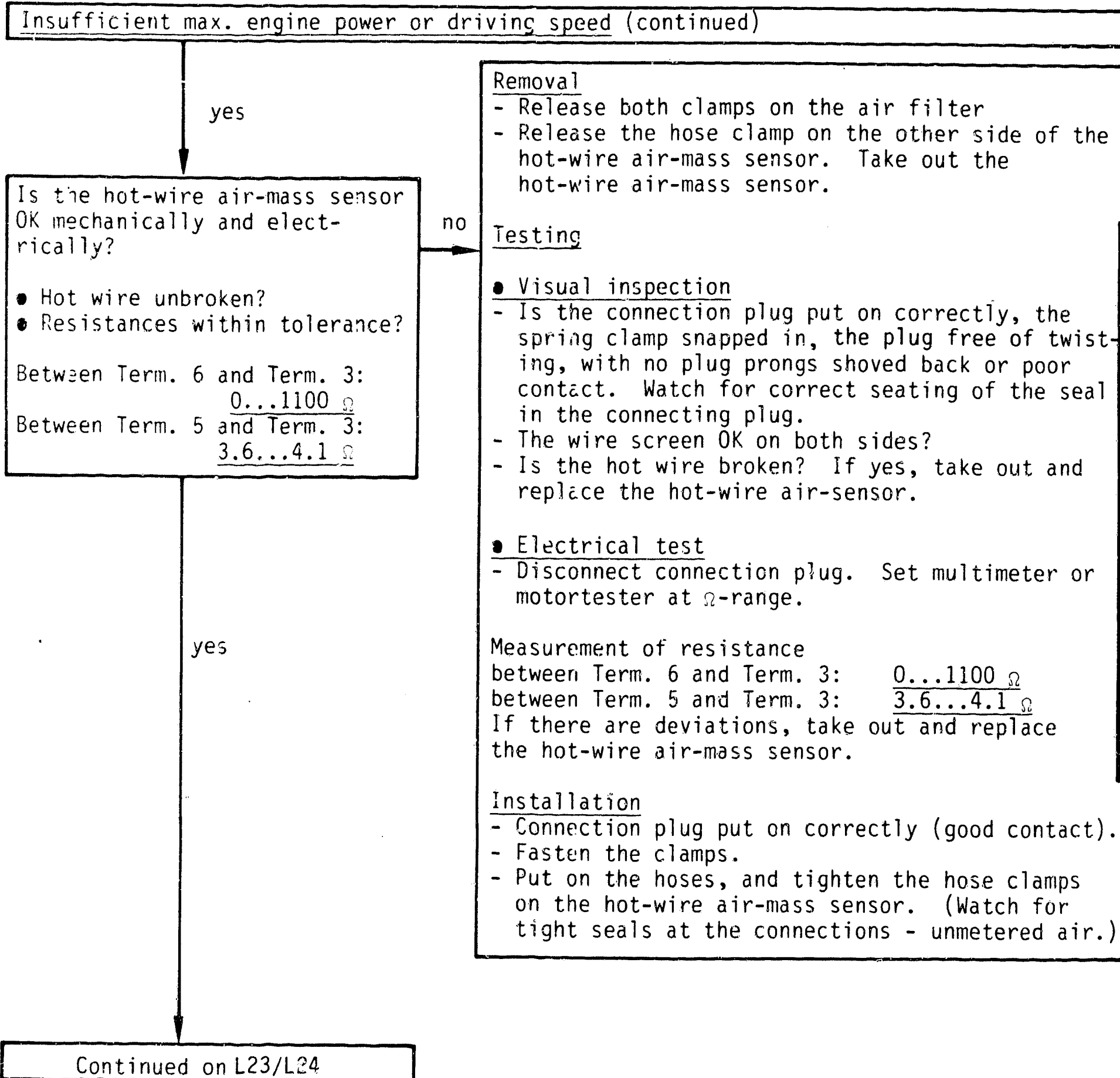
No max. engine power  
Saab



**L20**

No max. engine power  
Saab





- 1 = Hot-wire air-mass sensor
- 2 = Potentiometer for idle-mixture adjustment
- 4 = Clamps
- 5 = Hose clamps

**L21**

No max. engine power  
Saab



**L22**

No max. engine power  
Saab





Insufficient max. engine power or max. driving speed (continued)

yes

Are all hose lines and electrical lead connections correctly put on?  
Visual inspection.  
Has the intake system been checked for leaks?

no

Check that the hoses for the air intake system and the fuel line system have been put on correctly, without kinking or damage. If need be, take out and replace hoses. Correct leaks by using new seals or by tightening the connecting screws.

Checking for leaks

Seal off the exhaust pipe, unscrew the hose from the air filter to the air-mass sensor at the air-mass sensor and seal off the air-mass sensor channel (dust cover). Disconnect the hose after the auxiliary-air device. Seal off the auxiliary-air device connection. Using a compressed air gun (0.3 bar), blow into the hose to the intake manifold. In so doing, open the throttle valve all the way. Using soapy water, brush or spray all connections. Bubbling or foaming indicates leaks.

Caution!

Put all hoses back on and tighten hose clamps securely. Check for leaks.

yes

Checking the customer complaint

"Insufficient max. engine power or driving speed,"

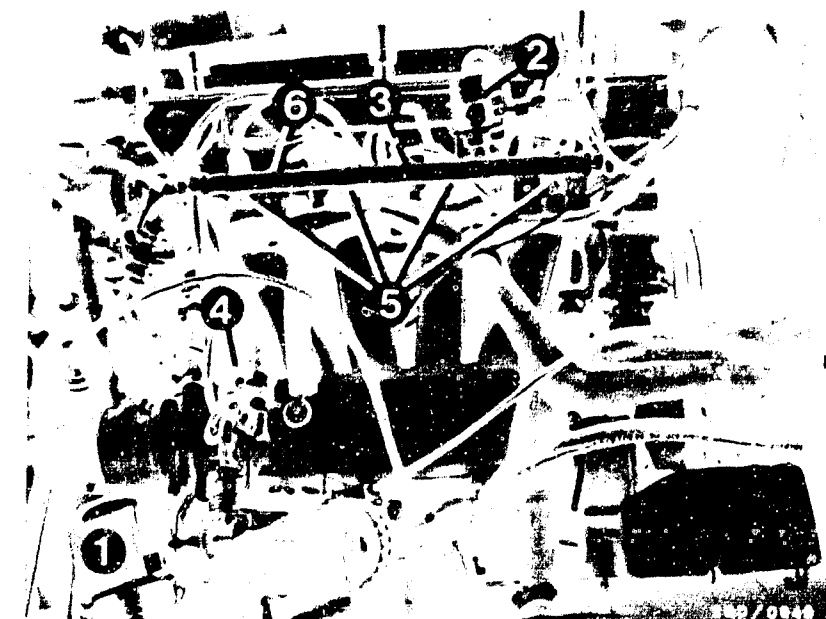
has been completed.

Has the customer complaint been corrected?

no

Other possible defects:

- The customer complaint has been incorrectly identified. (see Coordinates C3...C8.)  
If the defect has not been identified using the "targeted trouble-shooting," see "detailed trouble-shooting" (Coordinates C3/C4).
- Engine not OK mechanically (compression, valve setting, valve timing, wear on camshaft).



- 1 = Hot-wire air-mass sensor
- 2 = Pressure regulator
- 3 = Temperature sensor II (engine)
- 4 = Throttle-valve switch
- 5 = Solenoid-operated fuel-injection valve
- 6 = Ground terminal

**L23**

No max. engine power  
Saab



**L24**

No max. engine power  
Saab





## CO-ADJUSTMENT AT IDLE TOO LOW OR TOO HIGH

### Trouble-shooting program according to customer complaint

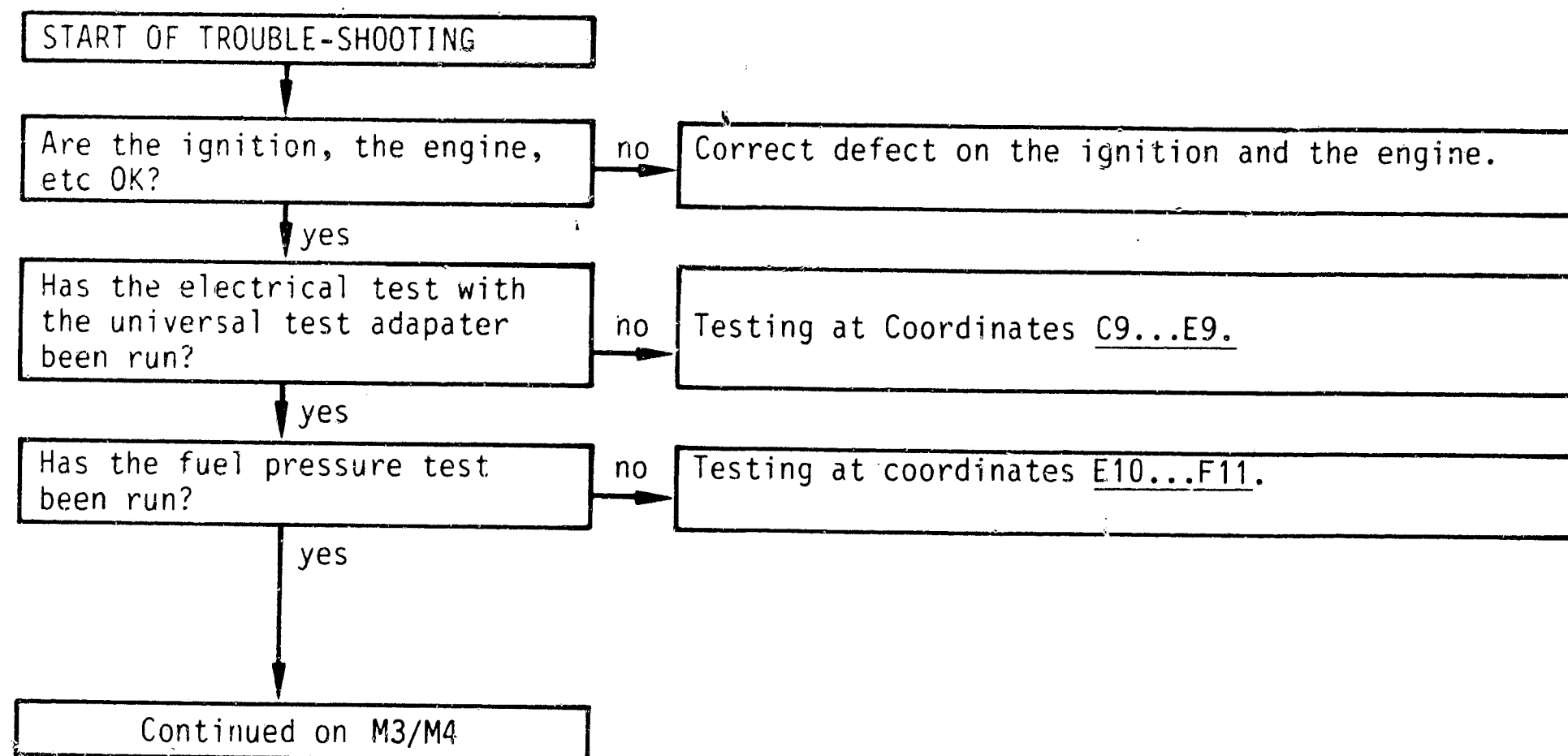
#### How to use the trouble-shooting program

Testing has been organized into 3 columns of boxes:

- In the column at the left are the questions for the tests being run.
- In the column at the center are descriptions of the tests and settings on components.
- The column at the right contains the illustrations that go with the text, and the legend for items in the illustrations.

If it is possible to answer the questions clearly with "yes" even without testing, proceed to the next question below.

If, on the other hand, the answer to the question is "no" and a defect is suspected, you must shift to the column at the center and run the tests indicated there. On completion of the testing, the trouble-shooting is continued at that point at which the shift was made earlier.



**M1**

CO-Adjustment  
Saab



**M2**

CO-Adjustment  
Saab



# CO-adjustment at idle too low or too high (continued)

yes

Is the auxiliary-air device OK mechanically?

Open cross-section:

- cold → open?
- warm → closed?
- drop in engine speed when the hose is pinched off? (cold engine)

no

## Testing:

- Visual inspection of the auxiliary-air device: disconnect the hoses and look through it (perhaps using a small mirror). When cold, the cross-section must be partially open, when warm it must be closed. If not, take out and replace the auxiliary-air device.
- Functional test of the auxiliary-air device: With the engine cold, pinch off the hose to the auxiliary-air device. The engine speed must drop off. When the engine is warm, pinch off the hose to the auxiliary-air device. The engine speed may drop off only unnoticeably. If otherwise, take out and replace the auxiliary-air device. (Watch the direction of through flow.)

yes

Is the electrical operation of the auxiliary-air device OK (voltage supply, ground lead, resistance)?

no

Start the engine.

- Voltage at the lead plug min. 12 V. If not, check the following leads for continuity (specified value approx. 0 Ω).
- From Term. 87 pump relay to the auxiliary-air device Term. 51.
- From Term. 52 auxiliary-air device to the ground terminal for the sensors.
- Resistance of the auxiliary-air device (lead plug disconnected)  
Manual transmission : 40...75 Ω  
Automatic transmission: 30...65 Ω

If the resistance is not within tolerance, take out and replace the auxiliary-air device.

yes

Continued on M5/M6



Arrow = auxiliary-air device

**M3**

Idle speed and CO-adjustment  
Saab



**M4**

Idle speed and CO-adjustment  
Saab



# CO-adjustment at idle too low or too high (continued)

yes

Is the start control OK?

(Control unit function)

- Connect the test lead between one solenoid-operated fuel-injection valve
- Disconnect the plug from temperature sensor II (engine)(blue plug).

Plug in temperature sensor 0 280 130 028 (plug color black).

- Connect the motortester or multimeter to the test lead (setting V, scale 10 V).

- Take out pump fuse No. 30.

- Connect ignition lead Term. 4 from the ignition distributor to ground via a spark gap.

Start the engine.

Does the value for voltage on the solenoid-operated fuel-injection valve drop off from approx. 2 V to approx. 0.8 V during starting?

(With the engine at normal operating temperature, or with NTC II plug plugged in, the value for voltage is less than 0.5 V).

After testing, restore the original condition of installation.

yes

Continued on M9/M10

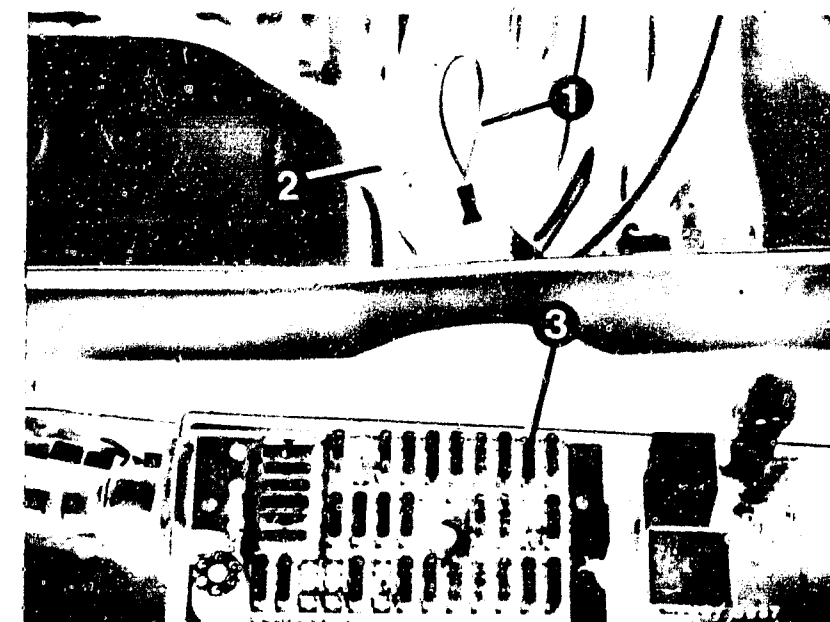
no

## Functional test

- Take out pump fuse No. 30 (in the central fuse box on the left fender).
- Disconnect ignition lead Term. 4 from the ignition distributor cap and connect to vehicle ground via a spark gap.  
(Caution! The engine must not start.)

## Caution!

When using spark gap EF 1177/7 1 684 531 000, an interference-suppression resistor of at least 2 k $\Omega$ , e.g. sleeve-type suppressor (5 k $\Omega$ ) 0 356 500 001, must be connected between the spark gap and ignition coil term. 4 in order to prevent the destruction of the control unit.



3 = Pump fuse

1 = Spark gap

EFAW 106A

1 681 100 001

2 = 5 k $\Omega$  sleeve-type suppressor

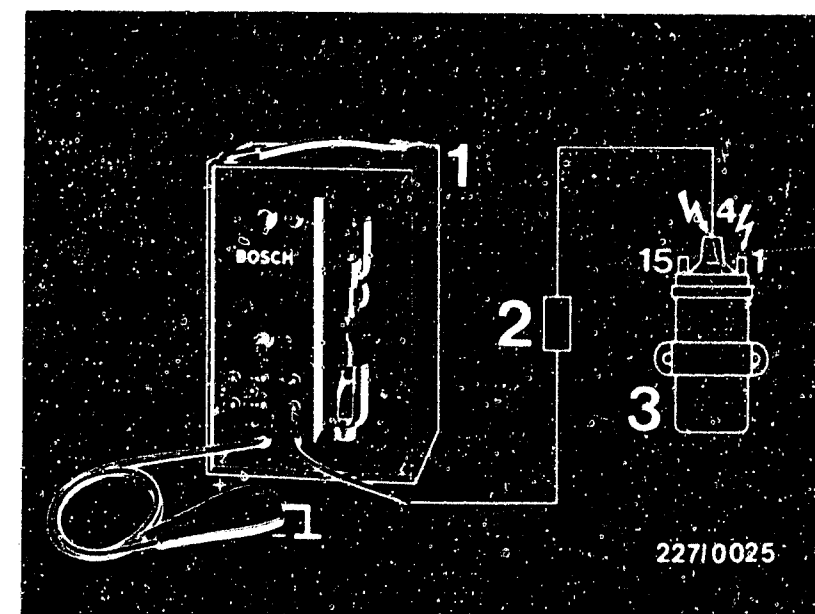
3 = Ignition coil

Caution!

Hazardous voltages

(400 V - 25 kV)

at terms. 1 and 4



M5

Idle speed and CO-Adjustment  
Saab



M6

Idle speed and CO-Adjustment  
Saab



# CO-adjustment at idle too low or too high (continued)

yes

- Put in two-pin adapter lead 1 684 463 093 between one solenoid-operated fuel-injection valve and its electrical connecting lead.
- Connect a multimeter or motor-tester to the free measuring pole. Measuring scale approx. 10 V.
- Pull cable plug from temperature sensor II (engine) (blue plug) and connect temperature sensor 0 280 130 028 (black plug).

## Measurement:

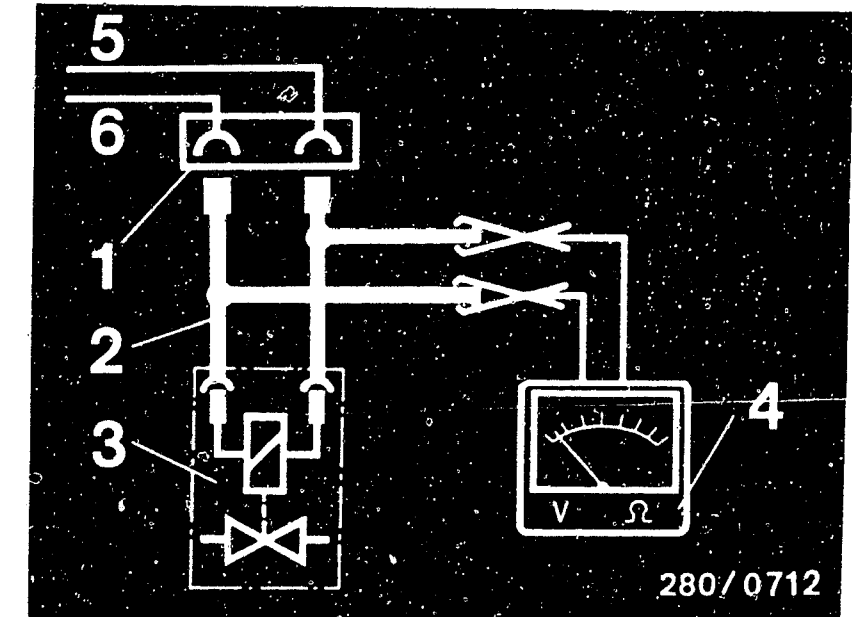
- Start the engine.
- Reading for voltage drops for an initial approx. 2 V to approx. 0.8 V within approx. 10 secs starting time.  
If these values for voltage are not attained, take out and replace the control unit.
- The voltage test cannot be repeated until after approx. 1 minute.
- Connect cable plug to series temperature sensor. When engine is at operating temperature start → voltage reading smaller than 0.5 V.

If not, take out and replace temperature sensor II.

## Caution!

After testing, restore the original condition of installation.

Continued on M9/M10



- 1 = Connection plug for the solenoid-operated fuel-injection valve lead.
- 2 = Test lead 1 684 463 093
- 3 = Solenoid-operated fuel-injection valve
- 4 = Multimeter or motor tester
- 5 = From pump relay Term. 87
- 6 = From control unit Term. 13

- 1 = Temperature sensor II (engine) on the engine block (blue plug)



M7

Idle speed and CO-adjustment  
Saab



M8

Idle speed and CO-adjustment  
Saab



CO-adjustment at idle too low or too high (continued)

yes

Are the solenoid-operated fuel-injection valves OK with regard to leaks?

no

yes

Continued on M13/M14

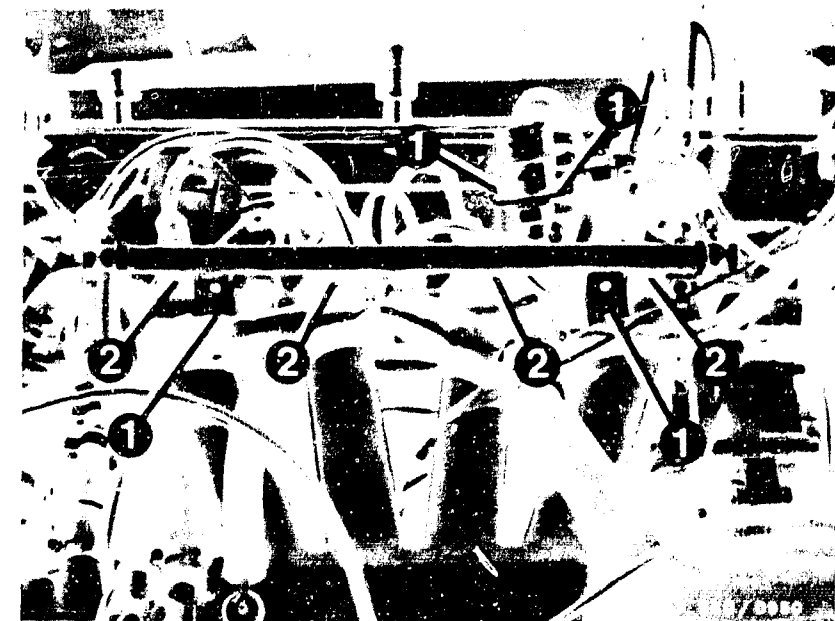
Checking the solenoid-operated fuel-injection valves for leaks:

- Take out the fuel distribution pipe and the solenoid-operated fuel-injection valves:
    - Release the fastening screws on the fuel-distribution pipe and the pressure regulator.
    - Carefully pull all 4 solenoid-operated fuel-injection valves out of the cylinder head at the same time.
  - Build up the fuel pressure:
    - Disconnect the control unit plug on the LH-control unit.
    - Make an auxiliary lead (lead diameter 1.5 mm with blade terminals 6.3 mm at both ends).
- Until 7.85:
- Disconnect 2-pin plug connection and connect auxiliary cable.
- This plug connection is between the brake power assist unit and the coolant overflow reservoir.
- As of 8.85:
- Pull out pump fuse no. 30 and hazard-warning and turn-signal system no. 27 and bridge with auxiliary cable.
- Ignition "ON", in-tank electric fuel pump should operate.

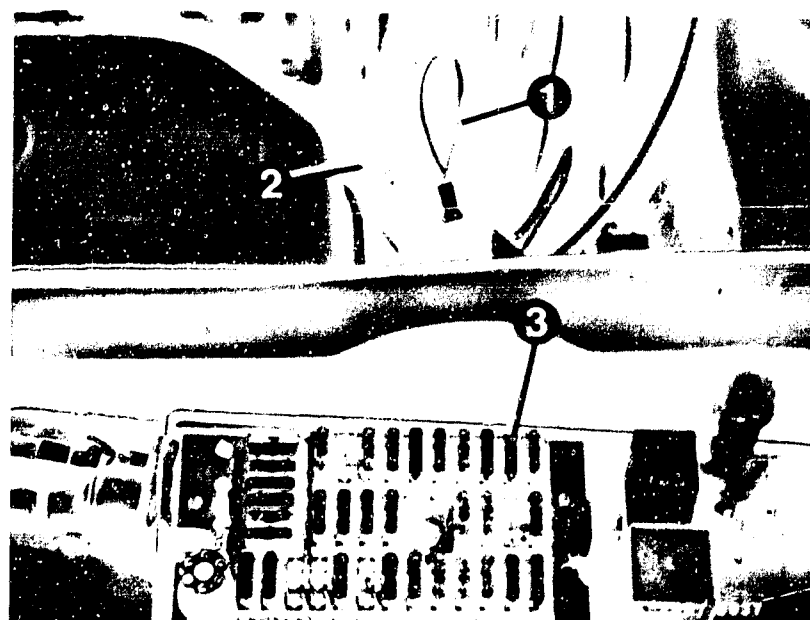
• Test specification:

Within 60 sec. there must be no drop formation at mouth of solenoid-operated injection valve.  
In case of defect, replace injection valve.

Continuation on M11/M12



1 = Fastening screw  
2 = Solenoid-operated fuel-injection valves



1 = Auxiliary lead  
2 = 2-pin plug connection

**M9**

Idle speed and CO-adjustment  
Saab



**M10**

Idle speed and CO-adjustment  
Saab



CO-adjustment at idle too low or too high (continued)

yes

● Removal

- Disconnect the electrical connection
- Carefully push the retaining bracket out of the slot
- Carefully pull the solenoid-operated fuel-injection valve out of the fuel distribution pipe.

Caution! Catch any fuel that runs out. Do not allow it to drip on hot portions of the engine.

● Installation

Caution!

Before installation, the two O-rings may be greased only lightly (silicone grease Ft 2 v 1). The other parts of the solenoid-operated fuel-injection valves must remain free of grease.

- Carefully put the new solenoid-operated fuel-injection valve on the fuel distribution pipe.
- Shove the retaining bracket into the slot on the solenoid-operated fuel-injection valve until the bracket latches. (Check the connection for leaks.)

Caution!

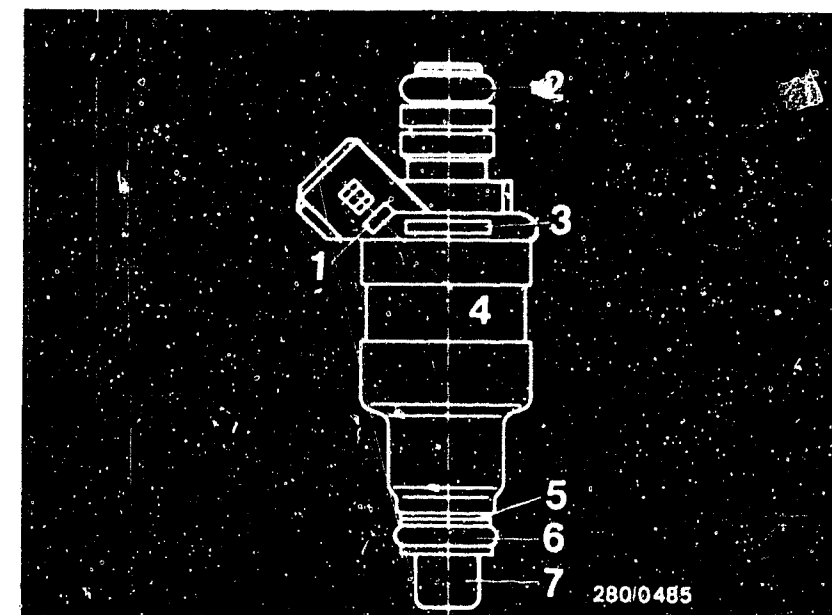
After testing, restore the original condition of installation.  
Check for leaks (unmetered air).

Continued on M13/M14



1 = Fastening screws  
2 = Solenoid-operated fuel-injection valves

1 = FD-marking  
2 = Top O-ring  
3 = Part No.  
4 = Solenoid-operated fuel-injection valve  
5 = Supporting plate (yellow, 2 mm)  
6 = Bottom O-ring  
7 = Protective sleeve



**M11**

Idle speed and CO-adjustment  
Saab



**M12**

Idle speed and CO-adjustment  
Saab



CO-adjustment at idle too low or too high (continued)

yes

Is the hot-wire air-mass sensor OK mechanically and electrically?

- Hot wire unbroken?
- Resistances within tolerance?

Between Term. 6 and Term. 3:  
 $0...1100\ \Omega$

Between Term. 5 and Term. 3:  
 $3.6...4.1\ \Omega$

no

Removal

- Release both clamps on the air filter
- Release the hose clamp on the other side of the hot-wire air-mass sensor. Take out the hot-wire air-mass sensor.

Testing

• Visual inspection

- Is the connection plug put on correctly, the spring clamp snapped in the plug free of twisting, with no plug prongs shoved back or poor contact. Watch for correct seating of the seal in the connecting plug.
- The wire screen OK on both sides?
- Is the hot wire broken? If yes, take out and replace the hot-wire air-sensor.

• Electrical test

- Disconnect connection plug. Set multimeter or motortester at  $\Omega$ -range.

Measurement of resistance

between Term. 6 and Term. 3:  $0...1100\ \Omega$

between Term. 5 and Term. 3:  $3.6...4.1\ \Omega$

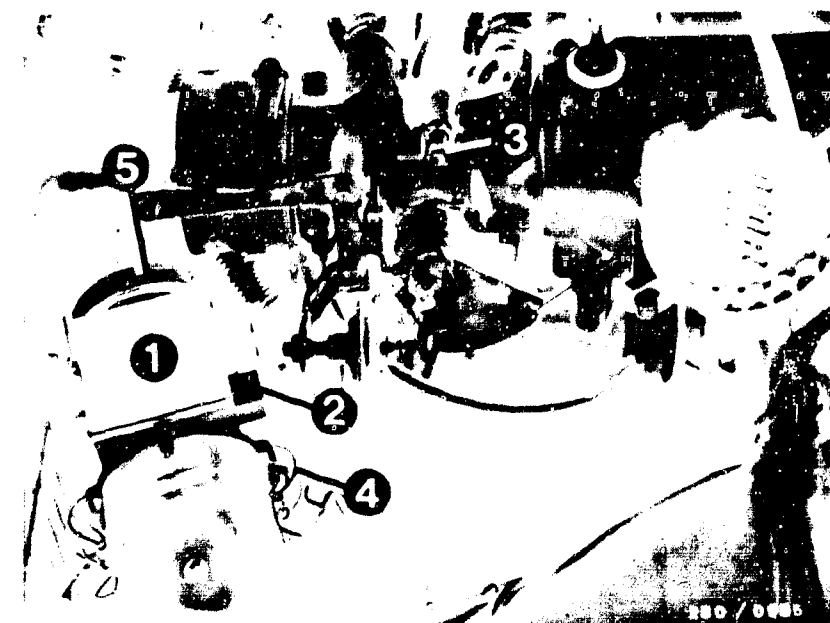
If there are deviations, take out and replace the hot-wire air-mass sensor.

Installation

- Connection plug put on correctly (good contact).
- Fasten the clamps.
- Put on the hoses, and tighten the hose clamps on the hot-wire air-mass sensor. (Watch for tight seals at the connections - unmetered air.)

yes

Continued on M15/M16



- 1 = Hot-wire air-mass sensor
- 2 = Potentiometer for idle-mixture adjustment
- 4 = Clamps
- 5 = Hose clamps

**M13**

Idle speed and CO-adjustment  
Saab



**M14**

Idle speed and CO-adjustment  
Saab





CO-adjustment at idle too low or too high (continued)

yes

Has the intake system been checked for leaks?

no

#### Checking for leaks

Seal off the exhaust pipe, unscrew the hose and the air filter to the air-mass sensor at the air-mass sensor and seal off the air-mass sensor channel (dust cover). Disconnect the hose after the auxiliary-air device. Seal off the auxiliary-air device connection. Using a compressed air gun (0.3 bar), blow into the hose to the intake manifold. In so doing, open the throttle valve all the way. Using soapy water, brush or spray all connections. Bubbling or foaming indicates leaks.

#### Caution!

Put all hoses back on and tighten hose clamps securely. Check for leaks.

yes

Continued on M17/M18



- 1 = Hot-wire air-mass sensor
- 2 = Pressure regulator
- 3 = Temperature sensor II (engine)
- 4 = Throttle-valve switch
- 5 = Solenoid-operated fuel-injection valves
- 6 = Ground terminal

**M15**

Idle speed and CO-adjustment  
Saab



**M16**

Idle speed and CO-adjustment  
Saab





CO-adjustment at idle too low or too high (continued)

yes

Have the CO and idle been set correctly?

no

CO and idle adjustment

Exhaust-gas adjustment using the exhaust-gas measuring device with the engine at normal operating temperature and at idle speed.

- When connecting to the exhaust-gas evacuation system when running the engine in the workshop, make certain that no excessively great vacuum occurs in the evacuation system because that could, among other things, affect the result of the measurement of CO levels. For the connection to the exhaust-gas evacuation system, see the Figure at the top.

If turbo vehicles are connected to excessively high pressure, that can cause oil to be pulled through at the turbocharger seals.

This drenches the steel wool in the exhaust system with oil, which causes blue smoke at the exhaust pipe even after fairly long periods of driving.

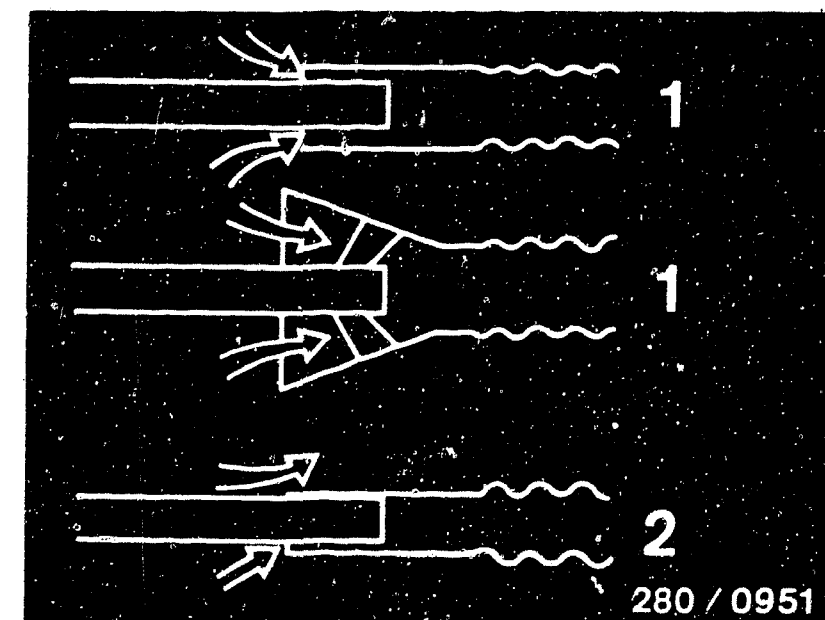
An excessive vacuum in the exhaust-gas evacuation system can be avoided by using exhaust-gas hoses with an open connection.

- An exhaust-gas recirculation, "EGR," has been installed in this vehicle due to certain exhaust-gas regulations.

yes

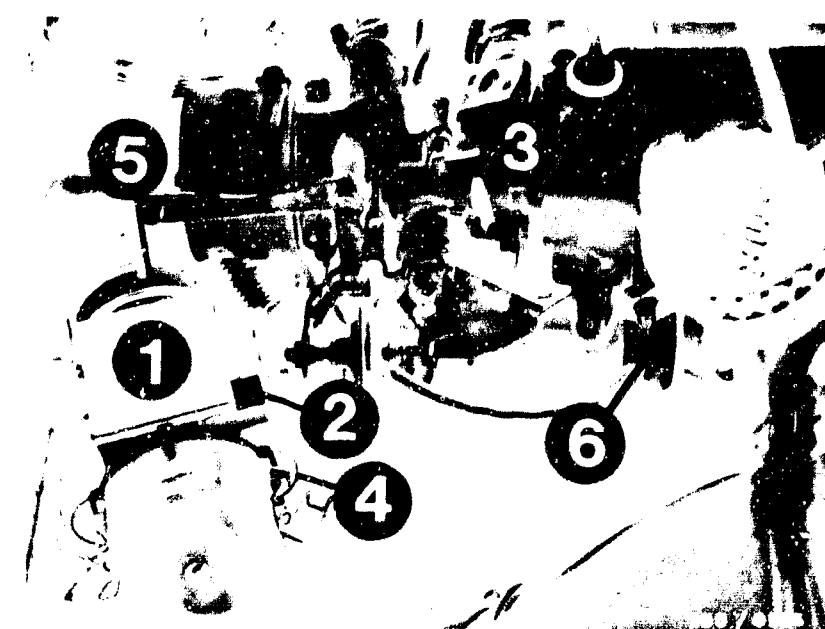
Continued on M19/M20

Continued on M19/M20



1 = correct  
2 = incorrect

6 = (Exhaust-gas) recirculation valve



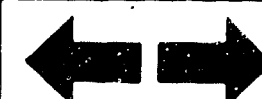
M17

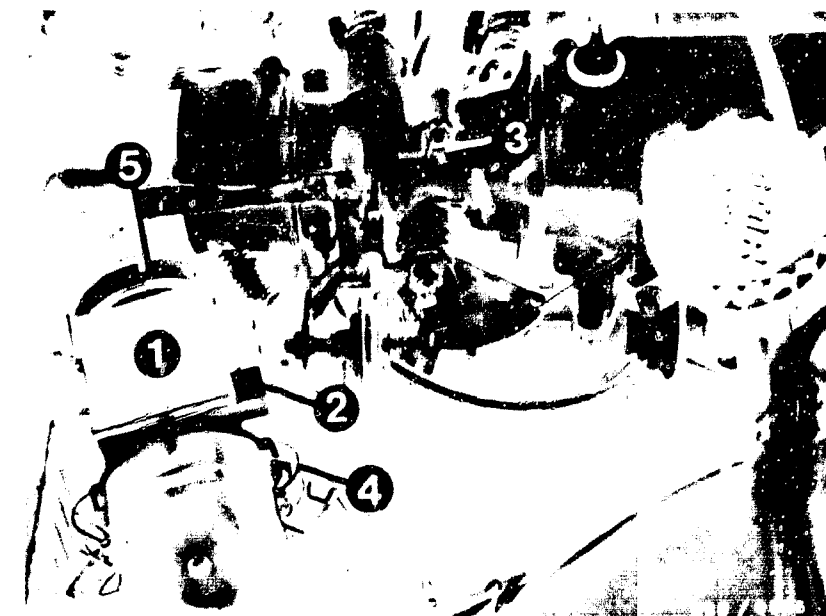
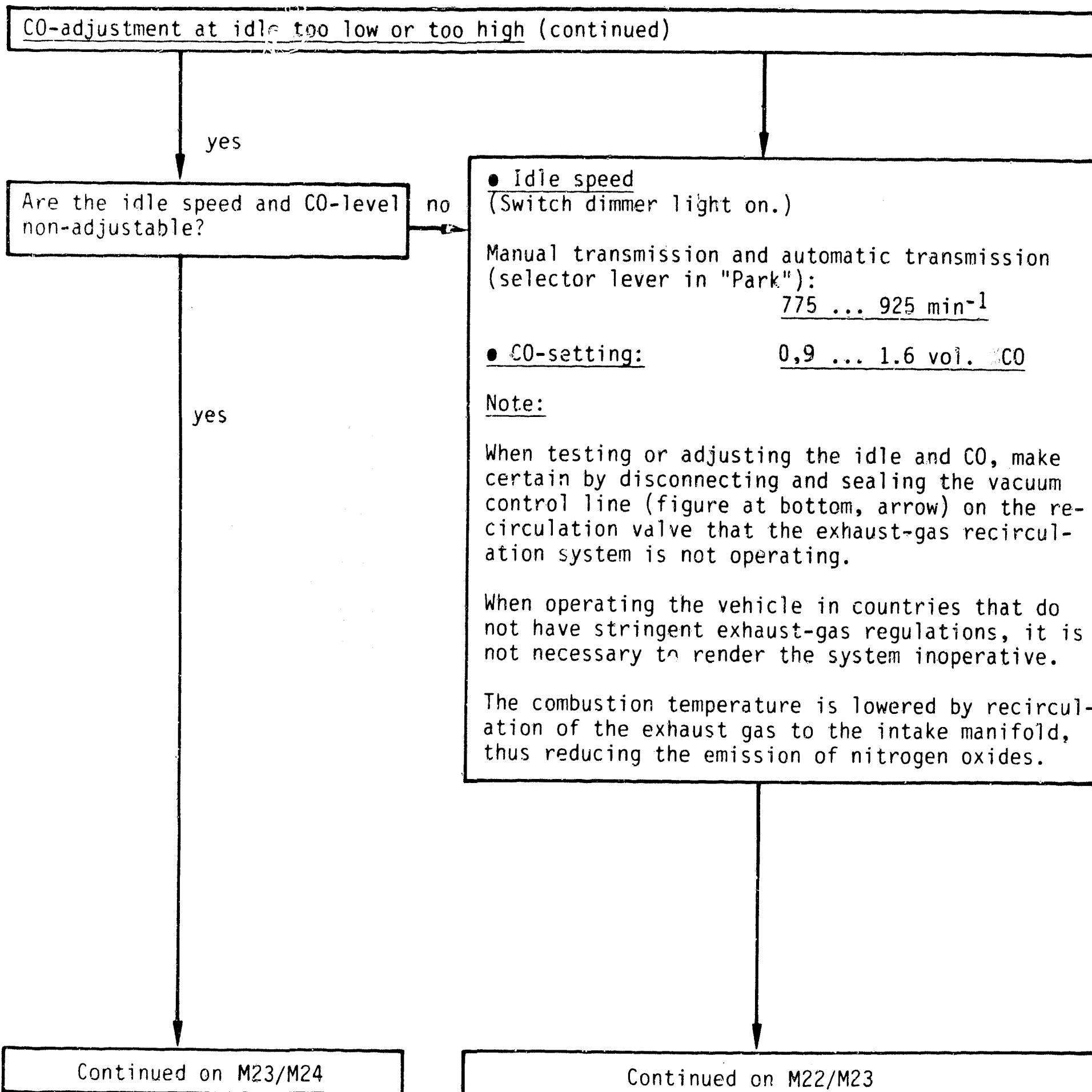
Idle speed and CO-adjustment  
Saab



M18

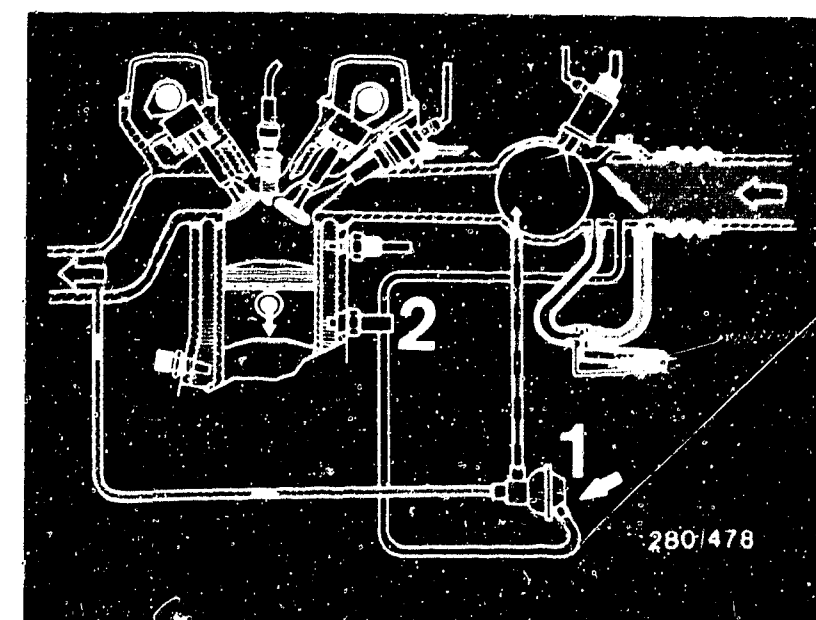
Idle speed and CO-adjustment  
Saab





2 = Potentiometer for idle CO-adjustment  
3 = Idle-speed-adjusting screw

1 = Recirculation valve  
2 = Thermostatic valve



**M19**

Idle speed and CO-adjustment  
Saab



**M20**

Idle speed and CO-adjustment  
Saab



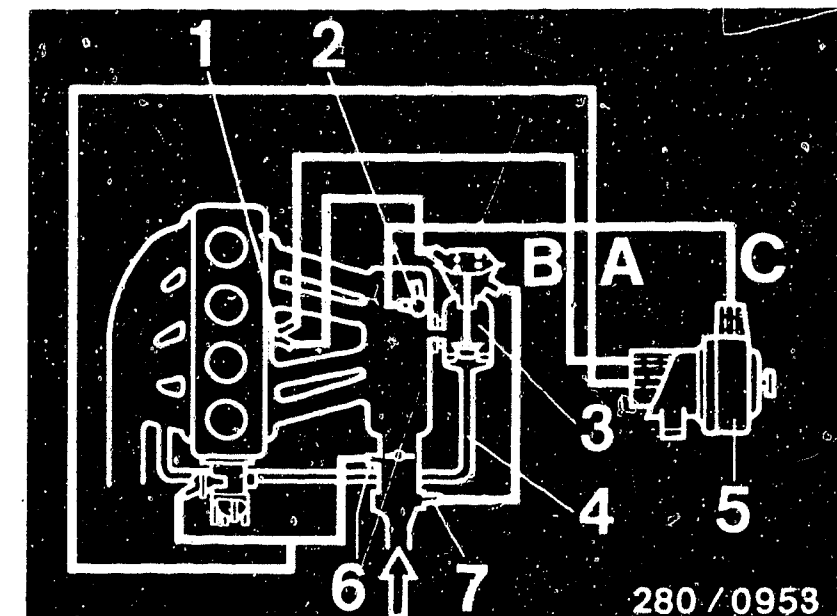
# CO-adjustment at idle too low or too high (continued)

yes

The system operates depending on engine temperature and intake manifold pressure. It is operative only with an engine temperature of more than approx. 20°C and only in part-load operation or at low load.

- Checking the operation of the exhaust-gas recirculation system:
  - Have the engine at normal operating temperature, and run it at idle speed.
  - Disconnect the hose to the signal converter connection A at the branch point behind the throttle-valve housing (ignition timing adjustment hose).
  - Disconnect the hose at the signal converter connection C. Close off the hose using a finger or some other method so that no additional air is drawn into the intake manifold.
  - Using a vacuum pump, or by sucking, create a vacuum in the hose A which has been released previously. If the system is functioning properly, the idle speed must drop off, and the engine may stop.
  - Reconnect the hose to the signal converter connection C.
  - With hose A, which was previously taken off, produce a vacuum once again. If the system is functioning properly, the idle speed of the engine must remain unaffected.
- Checking the thermostatic valve:
  - To check operation of the thermostatic valve, release the hoses and blow through the valve.
  - The thermostatic valve is screwed into the intake manifold flange toward the cylinder head.
  - If the engine temperature is less than 20°C, the valve must be closed.
  - At engine temperatures above 20°C, the valve must have an open passage.

Continued on M23/24



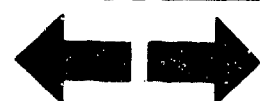
- 1 = Thermostatic valve
- 2 = Vacuum connection from the intake manifold
- 3 = Exhaust-gas recirculation valve
- 4 = Exhaust-gas recirculation pipe
- 5 = Signal converter
- 6 = Vacuum connection on the throttle valve (shared with ignition timing adjustment)
- 7 = Vacuum connection in front of the throttle valve

## Identification of the hose connections

- A = to the throttle-valve housing (ignition timing adjustment)
- B = via the thermostatic valve to the exhaust-gas recirculation valve (spring end)
- C = to the intake manifold (at the brake servo assist unit connection)

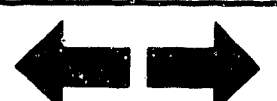
**M21**

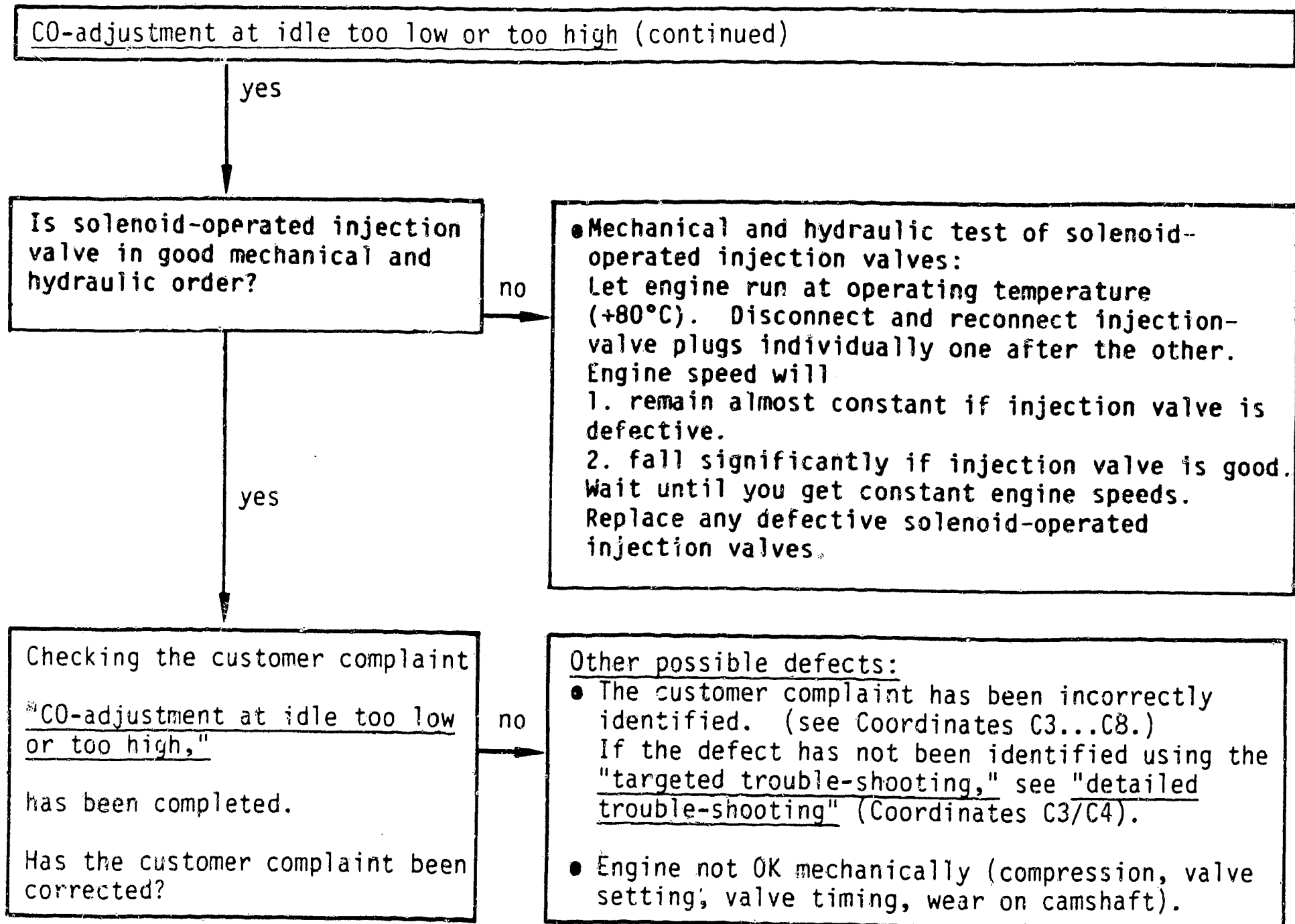
Idle speed and CO-adjustment  
Saab



**M22**

Idle speed and CO-adjustment  
Saab





# Technical Bulletin

Only for use within the Bosch organization. No to be communicated to any third party.

28

EXCHANGEABLE NON-RETURN VALVES  
in electric fuel pumps 0 580 464 ..

VDT-I-280/107 En

9.1984

(Supersedes Ed. 3.1983)

Electric fuel pump	Parts set (non-ret. valve and seal ring)	Non-return valve	Seal
0 580 364 002	---	1 583 386 011	1 580 203 001
0 580 464 005	---	008	001
006	---	008	001
007	---	008	001
009	---	008	001
010	---	008	001
017	1 587 010 002		
018	007		
021	006		
022	007		
024	006		
025	007		
027	006		
028	006		
029	1 587 010 506		
030	006		
031	005		
1 580 464 997	006		

Please direct questions and comments concerning the contents to our authorized representative in your country.

**N1**

Technical Bulletin

Saab



# After-sales Service

## Technical Bulletin

Only for use within the Bosch organization. Not to be communicated to any third party.

DETERMINATION OF THE TEMPERATURE VALUES  
GIVEN IN L-JETRONIC MANUALS

VDT-I-280/108 En  
5.1982

We have recently been asked with increasing regularity how accurately the engine temperature must be measured when trouble-shooting on the vehicle.

So far in its L-Jetronic manuals KH/VSK has given three or four different temperatures for testing the temperature sensor:

-10 °C, +20 °C, +40 °C and +80 °C,

and two ranges for the thermo-time switch e.g. 35 °C 8 sec.

below +30 °C and above +40 °C.

Since the temperature range need not be subject to such close tolerances, we propose in future the following more appropriate definition:

- Ambient temperature (approx. +15 °C to +30 °C)
- Engine at normal operating temperature (approx. +80 °C).

Please direct questions and comments concerning the contents to our authorized representative in your country.

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**N2**

Technical Bulletin

Saab



# After-sales Service

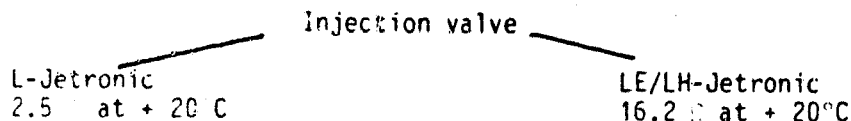
## Technical Bulletin

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CODING OF LE/LH-JETRONIC  
SOLENOID-OPERATED INJECTION VALVES

VDT-I-280/109 En  
5.1982

With the introduction of the LE/LH-Jetronic the internal resistance of the solenoid-operated injection valves has also been changed.



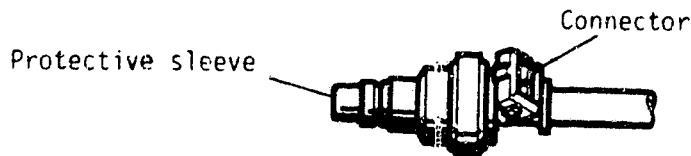
The connector has been left the same for cost reasons and to meet customer wishes.

### Caution!

If L-Jetronic injection valves are installed in an LE/LH-Jetronic vehicle, either the control unit or the injection valves will suffer irreparable damage.

### Note:

- Install only injection valves with the part number designated for the vehicle.
- As a guide, injection valves with 16.2  $\Omega$  internal resistance have a yellow protective sleeve.



- A colour coding (yellow) of the connector (see also VDT-I-280/5) is not generally intended for LE/LH-Jetronic injection valves.

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# After-sales Service

## Technical Bulletin

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28

VDT-I-280/110 En

6.1983

PARTS SET FOR INJECTION VALVES

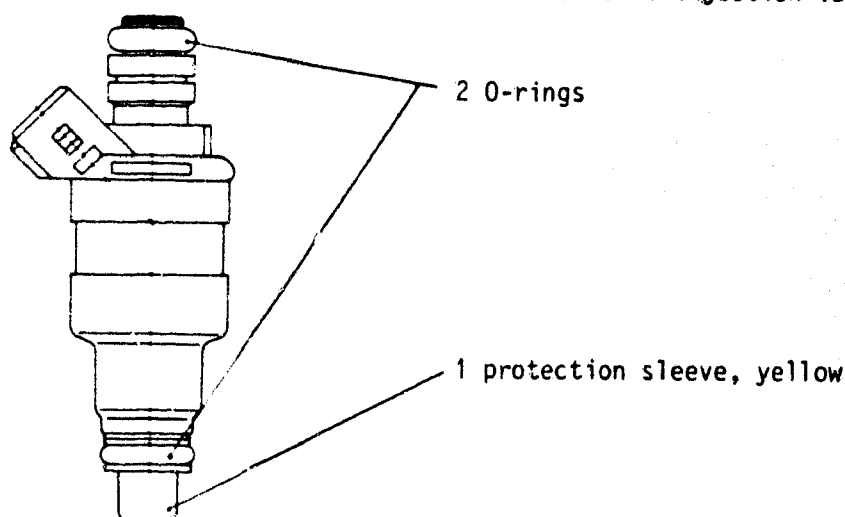
Supersedes 6.1982 edition

0 280 150 2..

AND PRESSURE REGULATORS 0 280 160 2..

A common parts set is available for the L-Jetronic/LE-Jetronic solenoid-operated injection valves and pressure regulators with the new method of connection.

Contents for 1 injection valve:



Contents for 1 pressure regulator:  
1 O-ring  
1 supporting plate

Since the above-mentioned parts are subjected to extreme temperature stress, they should be exchanged for new parts whenever servicing is carried out.

"Unmetered air" sucked in through injection-valve seals which are not tight, is a frequent case for servicing.

The parts set has the part number 1 287 010 704 and will in future be listed in the service parts microfiche under solenoid-operated injection valves (see EE 00 under 0 280..).

Please direct questions and comments concerning the contents to our authorized representative in your country.

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28

PLUG CONNECTORS FOR  
JETRONIC COMPONENTS  
Parts sets

VDT-I-280/111 En

11.1984

(supersedes edition 11.1982)

Parts sets are available for replacement of Jetronic plug connectors. These consist of:

- Plug connector housing
- Protective cap (rubber sleeve)
- Contact springs

These parts are listed on microfiche EE...\*.

\* see microfiche EE00 under 0 280 ..

- Plug, black, 2-pin,  
parts set 1 287 013 002 cable connector in conjunction with socket, 2-pin
- Socket, black, 2-pin,  
parts set 1 287 013 001 for e.g.

Temperature sensor	0 280 130 0..
Auxiliary-air device	0 280 140 ..
Thermo-time switch	0 280 130 2..
Start valve	0 280 170 ..
Warm-up regulator	0 438 140 ..
- Socket, grey, 2-pin  
parts set 1 287 013 003 for:

Solenoid-operated injection valve	0 280 150 ..
--------------------------------------	--------------

**N5**

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- Socket, black, 3-pin,  
parts set 1 237 000 039 for:

Throttle-valve switch 0 280 120 ..

- Socket, black, 5-pin,  
parts set 1 287 013 006 for:

Air-flow sensor 0 280 20. ..  
(LE version)

- Socket, black, 6-pin,  
parts set 1 287 013 004 for

Air-flow sensor 0 280 200 ..

- Socket, black, 7-pin,  
parts set 1 287 013 005 for:

Air-flow sensor 0 280 20. ..  
Air-mass sensor 0 280 211 ..

- Wiring-harness plug connector, black, 25-pin  
parts set 1 287 013 009 for:

Control unit 0 280 0..

- Wiring-harness plug connector, black, 35-pin,  
parts set 1 287 013 008 for:

Control unit 0 280 0..

The contact springs (minitimers) are also available separately under part no. 1 284 477 026.

The plug-connector housings are only available in the stated colours.

Responsible:

Robert Bosch GmbH

Division KH

Technical After-Sales Service (KH/VKD 2)

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# After-sales Service

## Technical Bulletin

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### New Product

(Exhaust Turbo-Supercharger System)

28

VDT-I-2P0/3 En

3.1981

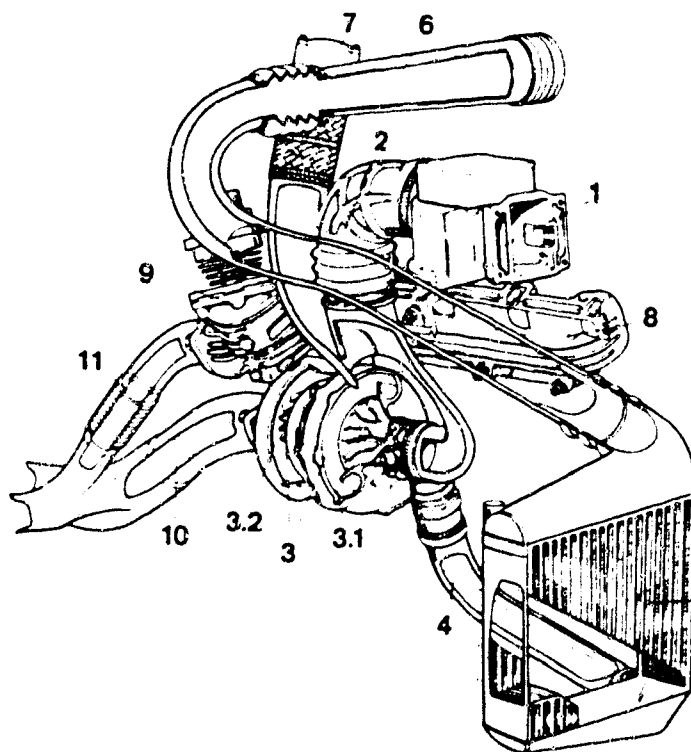
L-Jetronic with exhaust turbo-supercharger

As from September 1980, BMW have been delivering the 745i model equipped with L-Jetronic and an exhaust turbo-supercharger.

#### General:

The engine already in use in the 733i model, with L-Jetronic and a swept volume of 3.2 l, has been retained.

The intended increase in engine power has been achieved by fitting an exhaust turbo-supercharger specially adapted to this particular engine. The type designation 745i was chosen by BMW to signify this increase in power.



- 1 = Air-flow sensor meters the air drawn in
- 2 = Intake tube
- 3 = Exhaust turbo-supercharger, comprising the turbine (3.2) which is driven by the exhaust-gas stream, and the compressor (3.1) which is rigidly fixed to the turbine.
- 4 = Charge-air tube
- 5 = Charge-air cooler
- 6 = Charge-air intake connection
- 7 = Air-control valve for controlling the charge-air pressure during overrun
- 8 = Exhaust manifold
- 9 = Bypass valve
- 10 = Exhaust pipe
- 11 = Exhaust bypass duct

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### Functional description of the exhaust turbo-supercharger:

The turbine (3.2) is driven by the speed of the exhaust gas. The turbine and the compressor (3.1) are rigidly connected to one another. The air is drawn in by the compressor through an intake-noise damper (1) on the air filter and then through the air-flow sensor (2). Following the compressor, the compressed air is routed to the charge-air cooler (4). Here it is cooled down and then drawn into the individual cylinders of the engine through the charge-air intake connection, the throttle valve and the intake manifold (9).

Due to the fact that the charge-air pressure must not exceed approx. 0.7 bar, it has to be controlled. This is carried out by means of a bypass valve (6) at the exhaust manifold. The compressor and the bypass are joined by a control line (7). The turbine and the bypass valve are connected by a pipe to the exhaust system (8). As soon as the charge-air pressure becomes excessive, the bypass valve opens and permits a fraction of the exhaust gas to be diverted to the bypass duct of the exhaust system. As a result, the pressure applied to the turbine becomes less and the charge-air pressure sinks.

The compressor operates when the throttle valve is closed (and particularly during the actual closing process), this can lead to unwanted pressure shocks in the charge-air intake connection. These are prevented by the air-control valve (5). The air-control valve is connected to the intake manifold by a vacuum hose. The vacuum which is generated when the throttle valve closes opens the air-control valve and the charge air is diverted through the bypass line to the intake side of the compressor.

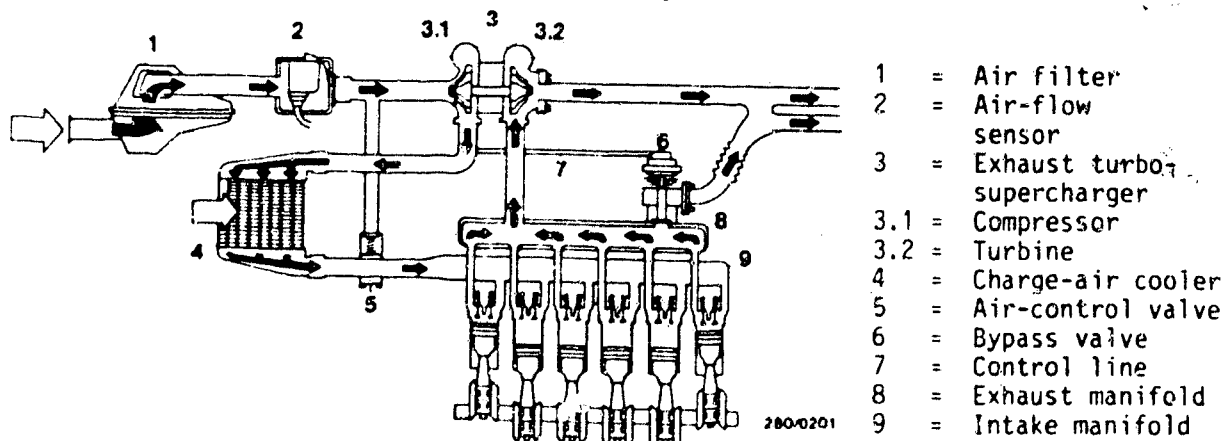
### Functional description of the charge-air cooler:

When the intake air is compressed in the turbo-supercharger compressor its temperature increases considerably.

This increase in intake-air temperature has two disadvantages:

1. The density of the air drops along with the rise in temperature and, as a result, the cylinder charge as well.
2. The combustion-chamber temperature rises and with it the thermal loading of the engine.

These disadvantages are prevented by the charge-air cooler.



Differences in the fuel induction of this turbo-supercharged engine to that of the normally aspirated L-Jetronic engine

In order to increase the engine power, the following measures are necessary:

The metering range of the air-flow sensor has been extended by fitting a stronger counterspring at the sensor flap. The injected fuel quantity has been adapted to the increased intake-air quantity by raising the fuel primary pressure during pressure-charged operation and by increasing the cross-sectional area of the fuel-injection valves.

Three additional control-unit functions have been incorporated in the turbo-supercharged engine:

1. Engine-speed limitation is by means of injection-pulse switch-off instead of through the ignition-distributor rotor as is usually the case. The advantage of this method lies in the fact that in the switched off range no unburnt fuel can get into the exhaust system and, under certain conditions, burn there.
2. During overrun, with the throttle valve closed (idle contact in the throttle-valve switch closed) the supply of fuel is interrupted up to an engine speed of  $1200 \text{ min}^{-1}$  by switching-off the injection pulses to the fuel-injection valves.
3. A safety circuit stops the supply of fuel to the engine, in case of excessive turbo-supercharger pressure, by switching-off the fuel-injection valves.



# After-sales Service

## Motor Vehicle Service Information

Only for use within the Bosch organization. Not to be communicated to any third party.

EXPORT VEHICLES WITH  
EMISSION CONTROL SYSTEMS

VDT-I-Gen. 042 En.  
12. 1981

K-Jetronic and L-Jetronic

Export vehicles for countries with stringent exhaust emission regulations are equipped with various emission control systems. To meet the legal requirements, these systems are installed either individually or in combination, depending on the model version.

Emission control system installed predominantly in export vehicles

	Sweden	Australia	Canada	USA	Japan
Exhaust-gas recirculation*	•	•	•	(•)	(•)
Secondary-air induction*	•	•	•	(•)	(•)
Secondary-air injection*	•	•	•	(•)	(•)
Catalytic converter*	-	-	-	•	•
Lambda closed-loop control	-	-	-	•	•

The vehicle-related After-Sales Service Instruction Manuals for the K-Jetronic and L-Jetronic describe the construction, function and operating principle of the emission control systems. The influence of these systems should be borne in mind particularly when adjusting the idle speed and CO concentration.

Export vehicles are sometimes also encountered in countries which do not have particularly stringent exhaust emission legislation. This Service Information publication summarizes the various emission control systems and provides information for the After-Sales Service in countries with exhaust emission legislation which does not require such emission control systems or unleaded fuel.

\* Not made by Bosch

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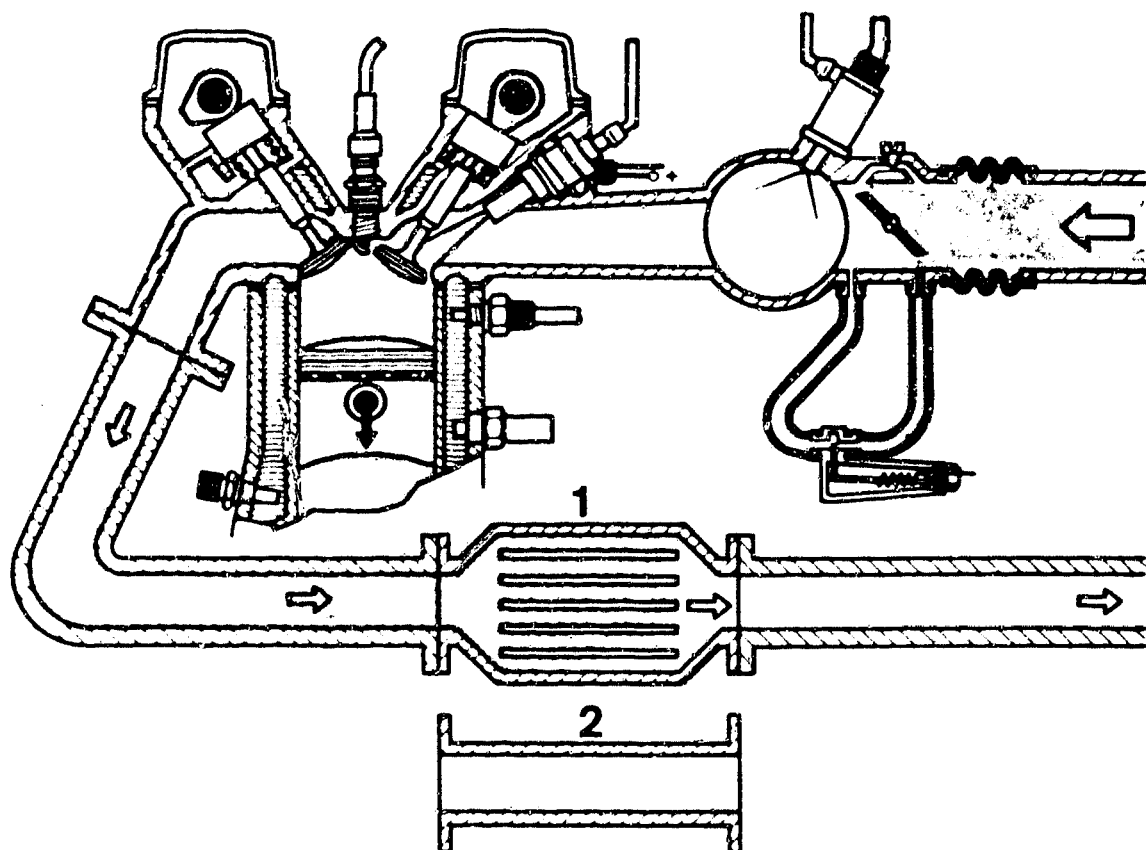
**N10**

Motor Vehicle Service Information

Saab



#### 4. Catalytic converter



1 = Catalytic converter

2 = Intermediate pipe

The single-bed catalyst installed in the exhaust system in export vehicles (also with lambda closed-loop control) reduces all three pollutants CO, HC and NOx to a minimum. The catalytic surface triggers chemical reactions of the pollutants, rendering them non-toxic.

Important: Proper operation only possible in conjunction with unleaded fuel (at present only in USA and Japan).

When testing or adjusting the idle speed and the CO concentration, the catalytic converter can be neglected since the exhaust-measuring point is upstream of the catalyst.

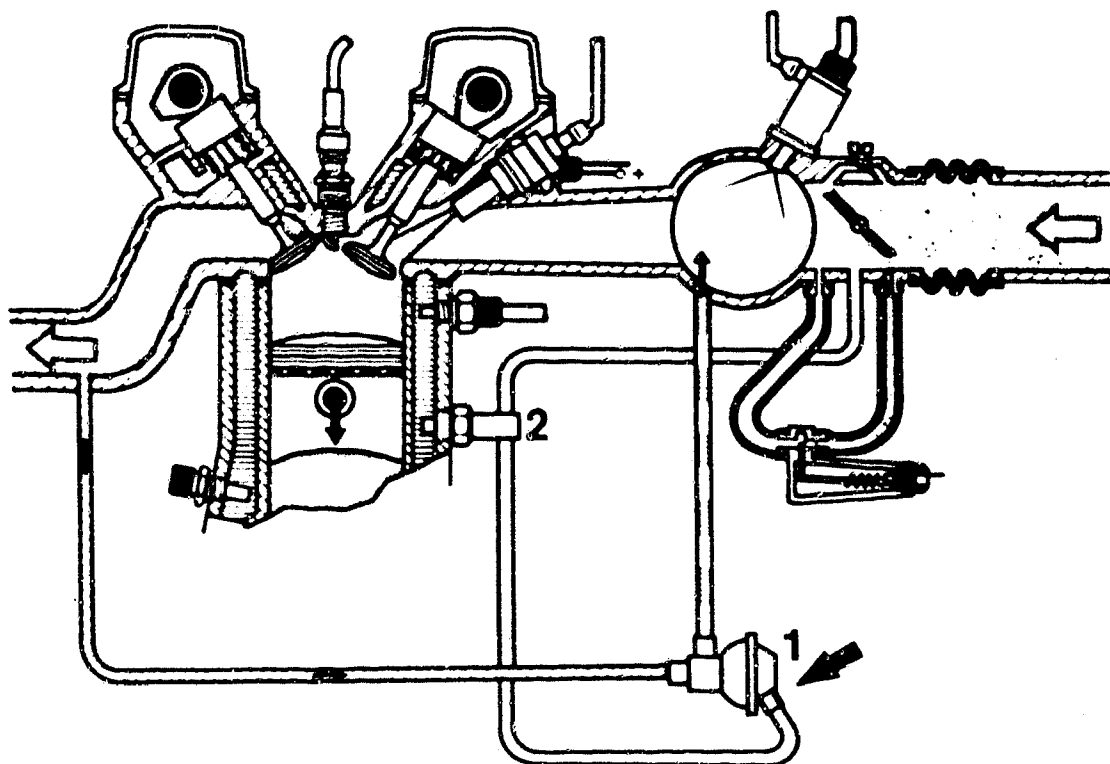
#### Caution!

If the vehicle is operated on leaded fuel (predominantly in countries without stringent exhaust emission legislation) the catalytic converter must be removed. If not removed, the catalytic converter would become clogged up and lead to a reduction in the power output of the engine.

Appropriate intermediate pipes for converting the exhaust system are available from the vehicle manufacturer.



## 1. Exhaust-gas recirculation (EGR)



1 = Exhaust-gas recirculation valve      2 = Thermo-valve

Some of the exhaust gas is returned to the intake manifold via a vacuum-controlled exhaust-gas recirculation valve. This recirculation of exhaust gas into the combustion chamber lowers the combustion temperature and reduces the emission of nitrogen oxides (NO<sub>x</sub>). The thermo-valve and the position of the vacuum tapping port on the throttle-valve assembly ensure that exhaust gas is only recirculated when the engine is warm and only at part load. There is a reduction in engine speed of about 200 min<sup>-1</sup>. Exhaust-gas recirculation is inoperative at idle, full-load and when the engine is cold.

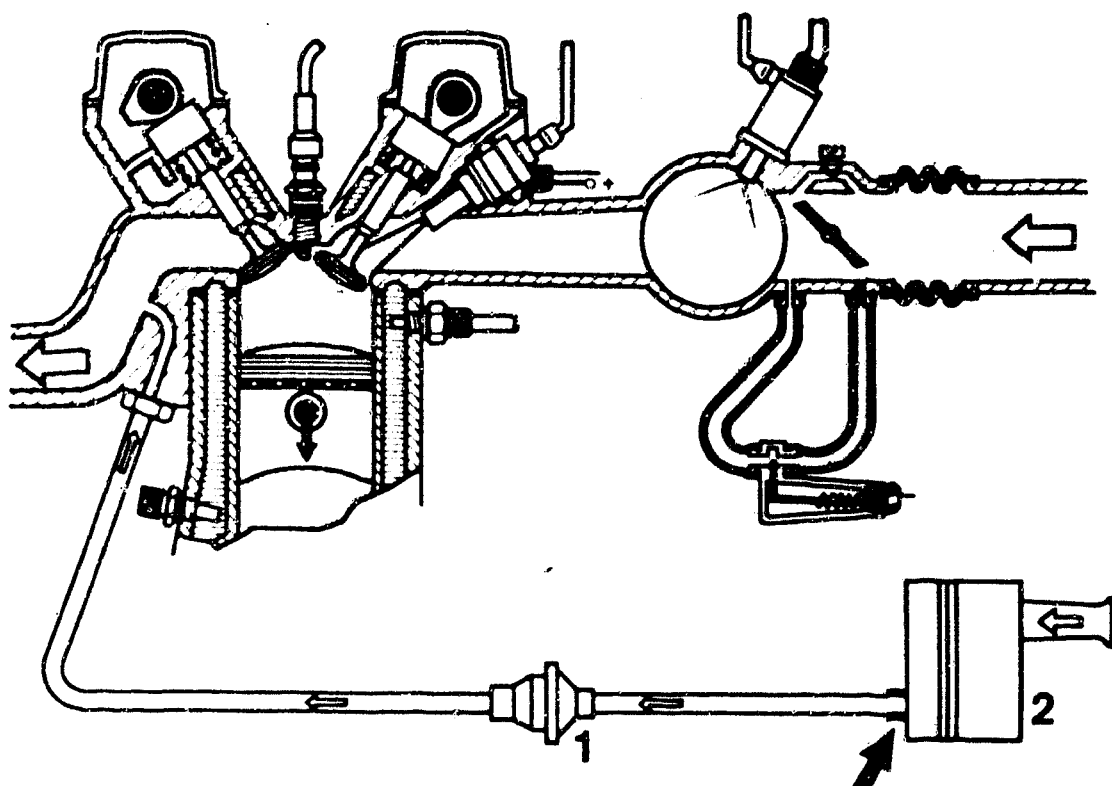
When testing or adjusting the idle speed and CO concentration, remove and seal off the vacuum control line (arrow) on the exhaust-gas recirculation valve in order to ensure that the exhaust-gas recirculation system is inoperative.

In countries without stringent exhaust emission legislation it is not necessary to shut down the system.





## 2. Secondary-air induction (e.g. Volvo Pulsair system)



1 = Non-return valve

2 = Air filter

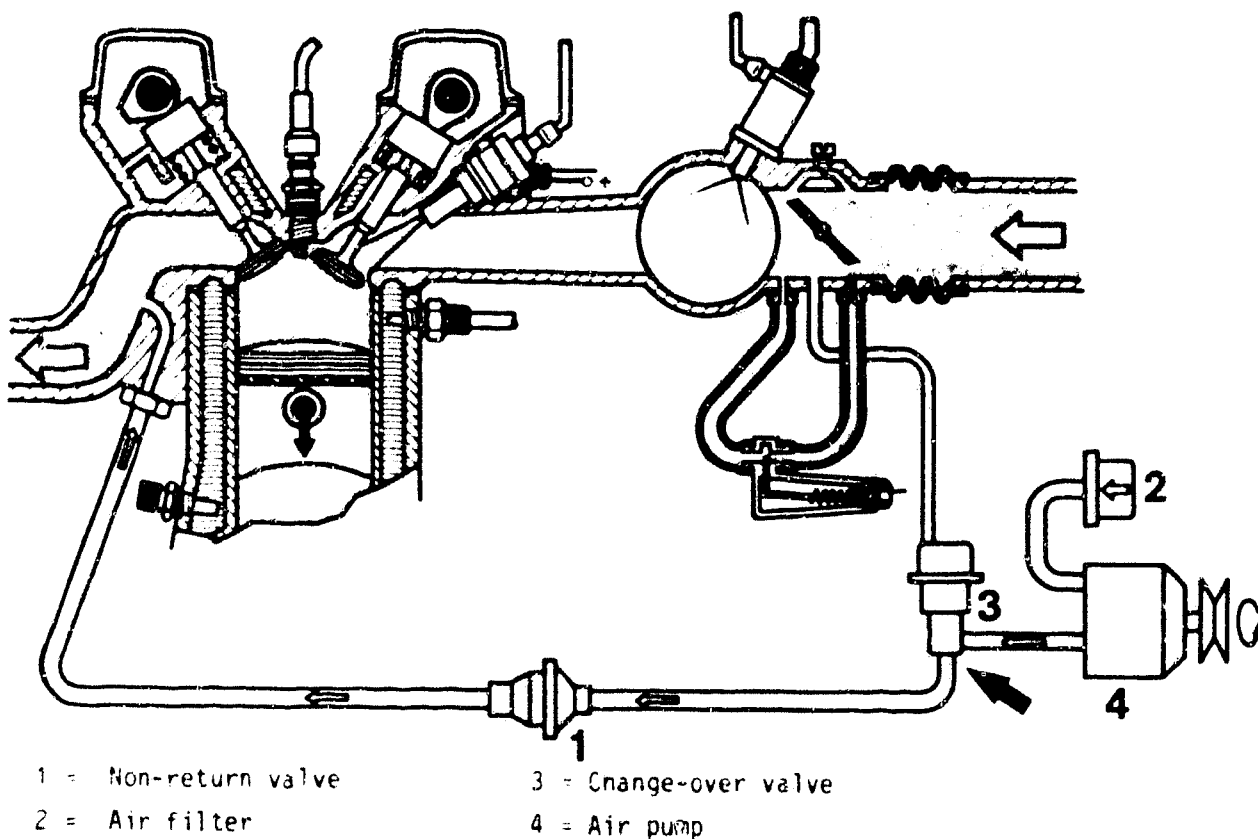
The pulsating alternation between overpressure and depression in the flow of exhaust gas inducts fresh air into the exhaust ports via a non-return valve. Unburned residues of carbon monoxide (CO) and hydrocarbons (HC) are partially after-burned, leading to fewer pollutants in the exhaust gas.

When testing or adjusting the idle speed and the CO concentration, the secondary-air induction system must be rendered inoperative. To do this, remove the hose between the non-return valve and the air filter on the air filter (arrow) and seal off tight with a plug.

In countries without stringent exhaust emission legislation it is not necessary to shut down the secondary-air induction system.



### 3. Secondary-air injection



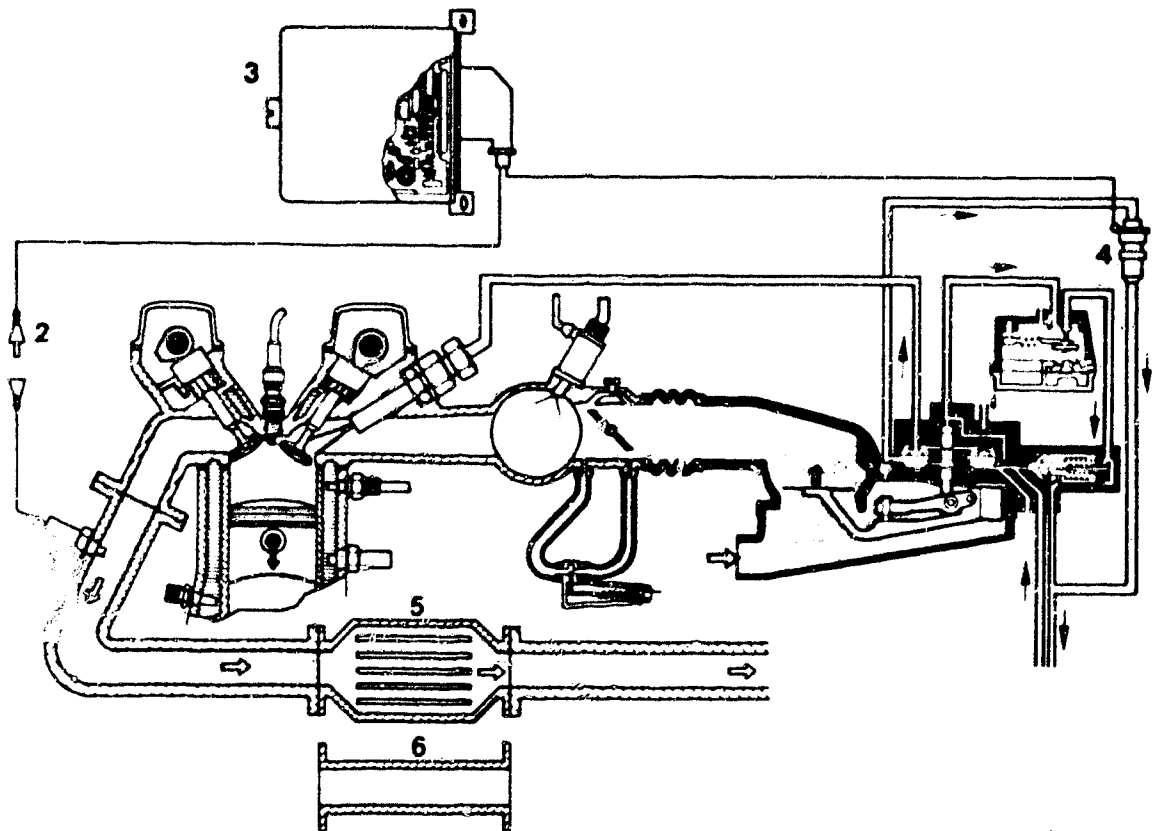
An air pump driven by the engine inducts fresh air through the air filter and forces it via a non-return valve into the exhaust ports. As in the case of secondary-air induction, there is a partial after-burning of the CO and HC residues. This makes the exhaust gas cleaner. A vacuum-controlled change-over valve controls the operation of the secondary-air injection system.

When testing or adjusting the idle speed and the CO concentration, shut down the secondary-air injection system. To do this, remove the hose from the outlet of the change-over valve (arrow) and seal off tight with a plug.

In countries without stringent exhaust emission legislation it is not necessary to shut down the secondary-air injection system.



## 5. Lambda closed-loop control



1 = Lambda sensor  
2 = Plug

3 = Control unit  
4 = Timing valve

5 = Catalytic converter  
6 = Intermediate pipe

Export vehicles for the USA and Japan are equipped with lambda closed-loop control. This additional function of the K-Jetronic or L-Jetronic is not a downstream emission control system, but ensures a low pollutant content in the exhaust gas by means of optimum mixture preparation. Additional exhaust-gas recirculation, secondary-air induction or secondary-air injection is therefore not necessary in most cases. Like the catalytic converter, the lambda sensor (in the exhaust gas) operates only with unleaded fuel.

If the vehicle is operated on leaded fuel, the lambda sensor becomes clogged up and ceases to operate. The control unit detects this and switches from closed-loop to open-loop control. The system then operates on a fixed air-fuel ratio in the same manner as a K-Jetronic or L-Jetronic without lambda-closed-loop control. Before operating on leaded fuel, the lambda sensor should be removed and the installation hole should be closed off with a screw plug M18x1.5 (length of thread max. 8.5 mm). The disconnected plug (2) of the sensor connecting cable should be insulated and fastened to a suitable place on the vehicle body.

### Caution!

Under no circumstances must the control unit or the timing valve be shut down on the lambda closed-loop control of the K-Jetronic.

The catalytic converter should be replaced by an intermediate pipe.

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